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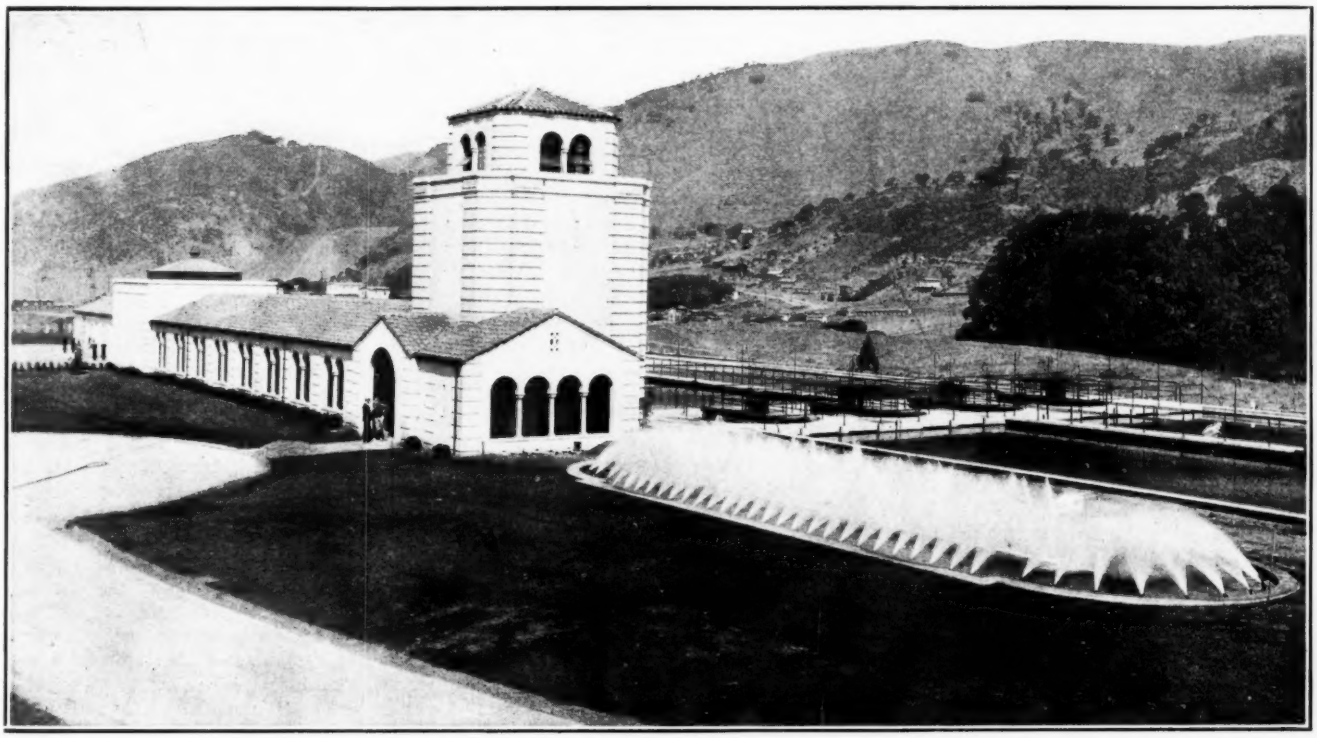


Operating Experiences With California Water Purification Plants

How Problems at East Bay Water Co. Plants Were Solved

By WILFRED F. IANGELIER

Associate Professor of Sanitary Engineering, University of California, and Consulting Sanitary Engineer, East Bay Water Co., and

JOSEPH D. DECOSTA

Assistant Sanitary Engineer, East Bay Water Co.

THE East Bay Water Co.* supplies water to Oakland and Berkeley, Calif., and other adjoining municipalities on the east side of San Francisco bay. The average daily consumption of water for 1927 was 32,000,000 gal., approximately two-thirds of which was filtered water from surface sources. There are two major filtration plants, the San Pablo plant, located just north of Berkeley, and the Upper San Leandro plant, 15 miles to the southeast in Oakland.

Raw Water Supplies.—Both plants are supplied with impounded waters of practically identical composition. The watersheds lie adjacent to one another and are of similar physical character. In general these waters are characterized by moderately high organic and mineral content and the reservoirs are subject to heavy growths of plankton or algae. The turbidities are flashy. During the heaviest run-off season, usually in February, the raw waters may attain turbidities of 2,000 or more p.p.m. Two weeks later the turbidities may have dropped to 25 p.p.m. and may not rise above this value for a full year.

The soluble and colloidal organic matter, mostly of vegetable origin, is continuously high. This is indicated by oxygen consumer values of approximately 10 p.p.m. and color of 40 p.p.m. A chlorine absorption test made recently gave a result of 70 lb. per million gallons, equivalent to 8.4 parts per million. These raw waters are capable of absorbing chlorine gas to upwards of 20 lb. per million gallons without causing taste or odor. That some of the organic matter is in colloidal suspension is indicated by the fact that the filtered water, although apparently clear, shows a marked Tyndall effect. It is practically impossible, with the use of ordinary alum dosages, to reduce the color to less than 15 parts per million.

The hardness of either water is slightly greater than its alkalinity and averages 3.5 milli-equivalents per liter or 175 parts per mil. The equivalent Sodium-Magnesium-Calcium ratios are approximately 1.0, 1.25, 2.25, and the Chloride-Sulphate-Bi-Carbonate ratios 0.75, 1.0, 2.75. The reaction of the water is slightly alkaline, pH=7.6.

The watershed lands that produce run-off water of this character are only sparsely wooded. Possibly 25 per cent

*The properties of the East Bay Water Co. have been taken over by the East Bay Municipal Utility District, which now operates them.

of the land is forested. The top soil is mostly clay. The lands are 70 per cent owned by the company and the density of population is very low, so human pollution is a negligible factor in the purification process. In 1927 only 10 per cent of 1,200 ton c.c. portions of raw water tested were found positive for M.R.+organisms of the Colon group.

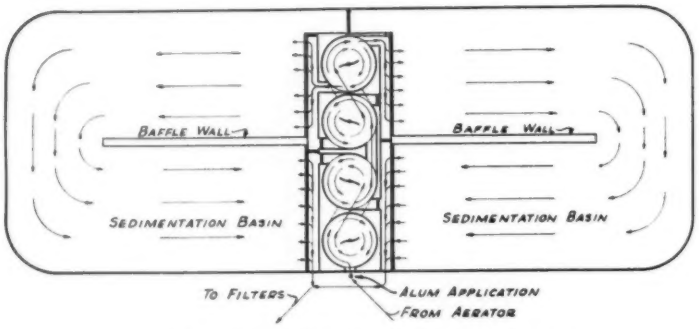
Other characteristics of the raw water which relate to the problems of purification are the seasonal presence of Plankton growths, more particularly the blue-green types of floating algae, and traces of Manganese, both of which may be very troublesome in connection with filtration.

Plankton Growths.—In this region, plankton or algae, if permitted, may grow abundantly the year around in practically all storage and open distributing reservoirs. In our storage reservoirs, where in many instances not more than 50 per cent of the water is replaced annually, the growths may be exceptionally heavy. Throughout the winter and spring months the plankton consists most of Crustacea and Rotifera and seldom exceed 10 p.p.m. by volume. Beginning in May or June, however, the sudden development of certain forms of Cyanophyceae may exceed 39 to 40 p.p.m., and if not controlled, may remain until October or November. Peak growths as high as 200 p.p.m. have occurred.

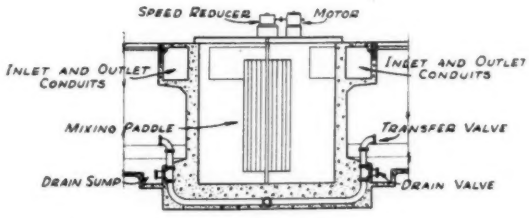
It has not been the practice to treat these stored waters with copper sulphate. The cost of such treatment, if given frequently in reservoirs holding upwards of five billion gallons, would be considerable, and since even the Blue-Green algae do not produce tastes and odors which survive the treatment process afforded these waters, coppering, up to the present time, has not been considered necessary.

In addition to the Crustacea which are present in varying density throughout the year, the predominating and most characteristic organism in the storage reservoirs is the Blue-Green alga Apanizominon. This organism has made its appearance each year and when the growth is at its peak a scum forms on the quiet waters around the margin of the reservoir which in places may be ¼ in. thick. Away from the shore the large masses are broken up by wave action, but the characteristic tiny clusters may be seen with the naked eye. Although this organism is reputed to impart to water a characteristic grassy taste and odor, our experience indicates that in the supplies under consideration taste and odor production is negligible until the organisms are undergoing decomposition. At such times the moldy odor, commonly associated with decay of vegetable matters, is usually noted. During periods of heavy growth, the removal from the water of the organisms themselves may add a heavy burden to the filter units. This burden is considerably lessened by excluding, from entrance into the intake, waters from the upper strata of the reservoir. These organisms do not penetrate, in large numbers, depths below 25 ft. except on very windy days. Treatment of the water at the intake with chlorine kills the organisms, but such treatment has not proven to be an advantage. Only a small portion of the organisms either dead or alive can be removed in the sedimentation basins after coagulation. When these growths are heaviest, the salvaging of the wash water from the filters, as ordinarily practiced, is dispensed with.

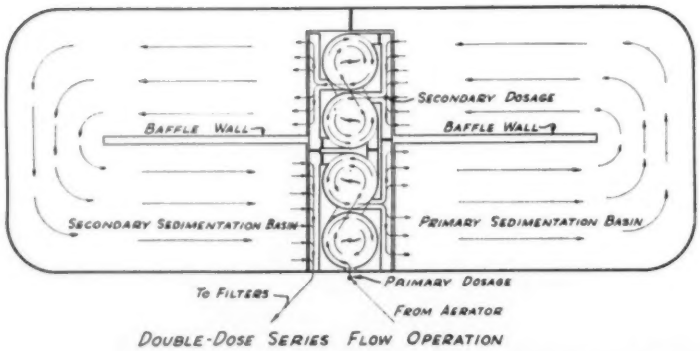
In the uncovered distributing reservoirs much algae trouble has been experienced in the past. We have found that during the summer and fall months dosing with copper sulphate, at regular intervals of about four weeks, is essential to the elimination of taste and odor complaints. Such treatment, moreover, not only prevents the periodic development of taste producing algae, but improves the appearance of the water by the destruction of brownish nannoplankton which otherwise would be present almost continually. It appears also that these treatments exert a cumulative effect in reducing materially the larger aquatic vegetation which formerly developed in some of the larger reservoirs. The elimination of nannoplankton requires a rather large dosage of copper sulphate. On a few occasions we have added as much as 15 to 20 lb. per million gallons of water. It seems that copper sulphate is less toxic to these smaller organisms. The effectiveness of chlorine in the destruction of



SINGLE-DOSE PARALLEL FLOW OPERATION



SECTION OF MIXING TANK



DOUBLE-DOSE SERIES FLOW OPERATION

EAST BAY WATER COMPANY
OAKLAND CALIFORNIA

COAGULATION AND SEDIMENTATION UNIT
UPPER SAN LEANDRO FILTRATION PLANT

Coagulation and Sedimentation Unit of Upper San Leandro Filtration Plant

bacteria would indicate the possibility that such treatment would be more effective than copper sulphate in the destruction of these smaller algae, but we have, as yet, no conclusive data on this matter.

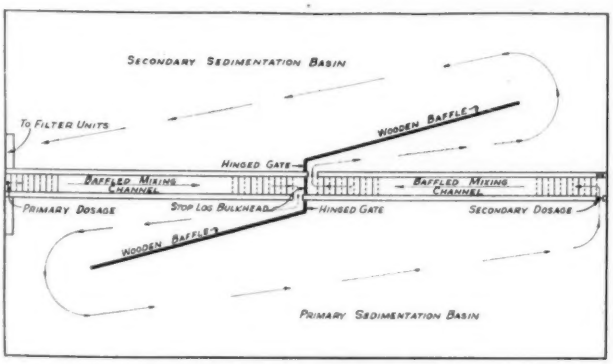
Filter Sand Troubles.—Within a few months after the San Pablo plant was placed in operation in 1921, a dark brown or almost black discoloration of the sand grains in the filter units was observed. This indicated the possible presence of manganese in the raw water and analyses confirmed this suspicion. The manganese content was found to be quite small, however, being somewhat less than one-tenth of a part per million. Realizing the damage that might result from permitting a manganese-bearing water to enter the distribution system, and also realizing the effectiveness of manganese-coated sand in removing manganese from water, it seemed desirable not to interfere with its further deposition. The discoloration and subsequent incrustation of the sand began at the top of the bed, where lay the finest sand, and gradually worked downwards. The first indication of any unfavorable effect was observed in connection with filter washing. The incrusted sand showed a marked tendency to cake, thereby causing the wash water to jet through the sand unevenly. In the course of a few months it became necessary to thoroughly prod the beds with rakes while admitting wash water. The condition of the sand kept getting worse until, in the summer of 1923, two years after beginning plant operation, under water cracking of the sand beds in very serious form occurred. At this time the upper 6 in. of sand had accumulated a heavy coating, equivalent to 20 per cent by weight. The amount of incrustation decreased with depth, averaging only a little over 1 per cent for the bottom 6 in. Analysis of the dried incrustation showed it to contain: Organic Matter 60 per cent, Aluminmum Oxide 26 per cent, and Manganese Dioxide 11.5 per cent. Describing this condition at the time, it was stated:

"The incrustation as found on the sand grains when a filter is drained is heavily hydrated, and when the sand is compressed in the hand the feel is like that produced by squeezing a handful of granular cork or rubber. The wet sand is also very plastic, so much so that a rod forced into the sand to the gravel layer, upon withdrawal will leave a perfect impression. If the wash water is then turned on, a jet will be formed at this point."

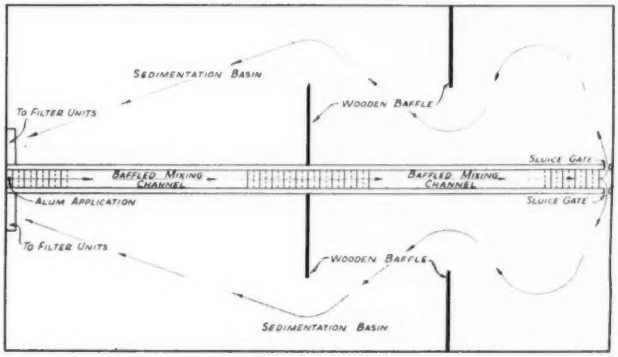
Much has been written concerning filter sand incrustation and filter bed cracking, which is sometimes associated with it. Our observations lead us to believe that filter sand incrustation may develop regardless of the character of the sand, provided the water is of a certain character and contains essential constituents, as for example, traces of manganese, colloidal calcium carbonate, suspended organic matter, etc.; and that cracking may occur if the coated sand is sufficiently compressible and subject to vertical stratification with relatively incompressible clean sand from underneath and brought to the surface by the jetting action of the wash water. We believe that the cracks are formed by unequal settlement of the sand bed, and that having once formed are subject to enlargement as a result of lateral compression of the vertical filtering surfaces. The correctness of this theory was indicated by frequent examinations of the sand on opposite sides of a crack and also from the observation that when a filter was drained immediately after washing, small cracks were formed upon standing, and always in a plane of vertical stratification.

It occurred to us that a system of washing more effective than the high rate water wash and the temporary experient of hand raking would be desirable. These units are designed with perforated pipe underdrainage and it seemed a very simple matter to adapt them to supplementary air agitation. It was assumed that a preliminary blowing of air through the bed would loosen the compacted sand and permit of a better wash water distribution.

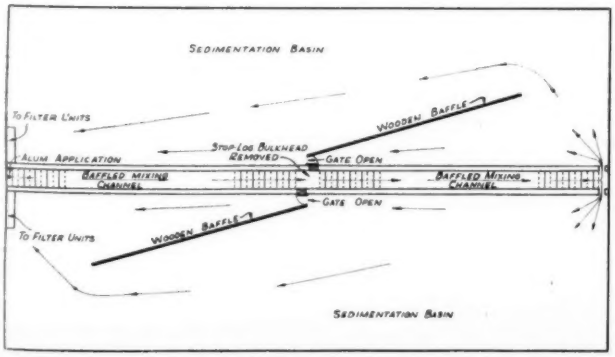
Accordingly, a complete unit was dismantled, the laterals carefully leveled, and the central manifold tapped to admit air. This unit was operated through a full season with excellent results and complete freedom from cracking. The following year the remainder of the units were treated in a similar manner. Since the introduction of air applica-



DOUBLE-DOSE SERIES FLOW OPERATION



SINGLE-DOSE PARALLEL FLOW



SINGLE-DOSE PARALLEL FLOW

Diagram Showing Alterations to Coagulation and Sedimentation Unit of San Pablo Filtration Plant

tion preliminary to the water wash, we have not once observed any cracking of the sand.

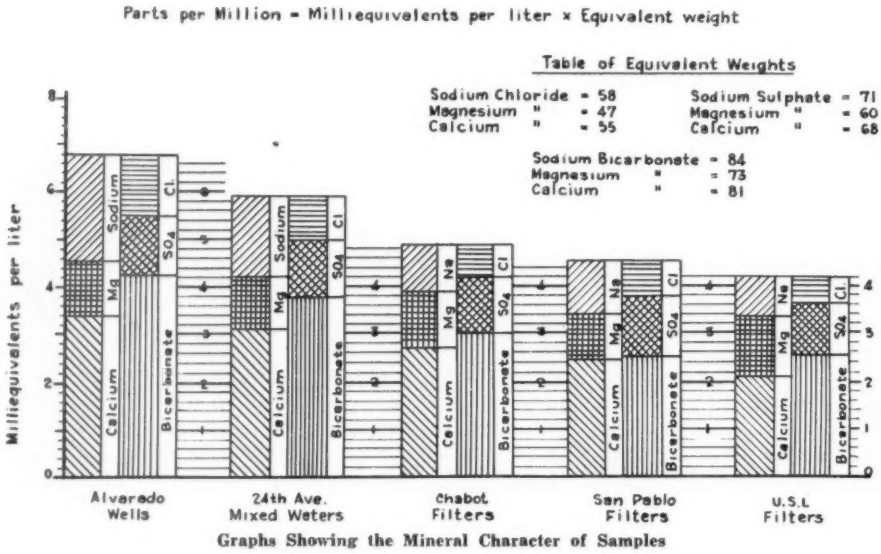
With this experience as a guide, the newer Upper San Leandro plant was designed for both preliminary air application and high rate water wash. We are convinced that air application is a cheap and effective method of preventing filter troubles caused by sand that has become plastic through coating of the grains. We have observed that the application of air in this manner does not materially agitate the sand. Its effectiveness depends upon a mere piercing of the plastic sand directly above each orifice such that the water may loosen subsequently the entire bed.

In this connection, it should be noted that the successful distribution of air through perforated pipe drainage laterals requires that they be set perfectly level. Studies made with separate laterals submerged under water showed that a difference of elevation of ⅛ in. at the opposite ends of a 14-ft. lateral was sufficient to impair distribution.

In the matter of manganese deposition, however, we are still perplexed with at least one phenomenon. Whereas at the San Pablo plant the fine sand at the top of the bed was the first to become coated, at the Upper San Leandro plant the gravel became coated before any of the sand was affected. We are unable to explain this definitely at the moment, but we suspect that it has to do with bacterial activity influenced by oxygen potential. In the latter plant the admission of air preliminary to washing may have been sufficient to maintain aerobic conditions in the gravel layer. At the San Pablo plant a gradual depletion of the dissolved oxygen content of the water, as it passes through the sand bed, indicates aerobic activity in the upper sand layers where the deposition occurs. One other condition surrounding these experiences is the fact that at the San Pablo plant the gravel was found to be quite heavily incrusted with iron oxide resulting from corrosion of the steel underdrains. It is well known that manganese oxides are not readily precipitated in the presence of ferrous iron. At the Upper San Leandro plant the underdrains are of brass tubing and iron deposits in the gravel are absent.

Salvage of Soiled Wash Waters.—The high cost of raw water development in this locality is such as to warrant the salvaging of soiled wash waters. This is accomplished at both plants with the use of suitable storage basins and pumping equipment. At times of excessive plankton growth, it is necessary to waste some of these waters for short periods each year. We estimate, however, that upwards of 95 per cent of these waters are redeemed, and this at a very considerable saving in water development costs. Throughout the greater part of the year the quality of this water after sedimentation compares very favorably with that of the original raw water. We believe that the ideal basin should provide a capacity equal to the wash water production for 24 hours, the return of the water to be distributed over a period of about 12 hours.

One item of interest in this connection relates to the problem of preventing accumulations of Crustacea which are not removed by sedimentation and are not easily destroyed with an algaecide. For a time this gave us some trouble until we hit upon the idea of their destruction on the filter beds by desiccation. This is accomplished by draining the filter unit and keeping it out of service for several hours. After such treatment the dead organisms are easily removed by sedimentation in the storage reservoirs. Where filter capacity is limited, it is believed that spraying the drained filter surface with an algaecide would accomplish the same result instantaneously; we have not, however, had occasion to give this a trial.



Graphs Showing the Mineral Character of Samples

Coagulation and Sedimentation.—The San Pablo plant as originally designed and built was found to be somewhat inadequate with respect to coagulation and sedimentation facilities. It was found that the highest turbidities occurring from three to four weeks each winter could not be lowered to the point of yielding a perfectly clear filtered effluent, even when the plant was operated at one-half capacity. This is believed to have been due to a variety of causes.

The coagulation and sedimentation unit as originally designed comprised two rather long rectangular basins, separated longitudinally by a shallow mixing channel, equipped with the usual "over and under" type of wooden baffles. The arrangement was such that the sedimentation basins could be operated only in parallel. Short circuiting occurred in these basins to an abnormal extent, due partly to the absence of suitable and properly designed inlet and outlet facilities. Wing baffle walls were first experimented with, but the results were not altogether satisfactory. Later, laboratory experiments indicated the desirability of double coagulation and sedimentation for the preliminary treatment of this water. In 1924 the basins were temporarily equipped to operate in this manner. The results were so satisfactory that permanent alterations were later made.

The problem of converting the existing parallel flow basins into series flow with double treatment and mixing was solved in what we regard to be a rather unique and highly satisfactory arrangement. This can best be visualized by reference to the accompanying sketches.

The mixing channel was blocked off at the middle point. On opposite sides of this bulkhead and in opposite walls of the channel an outlet weir into each basin was made. Opposite these outlet weirs, and somewhat diagonally toward opposite ends of each basin, a wooden baffle wall was installed. With this arrangement the water is given a primary dosage of alum, after which it flows through one-half of the total length of mixing channel, is diverted into the primary settling basin, through which it flows in a gradually retarded velocity into the far end of the mixing channel, where it receives a second dosage of alum. The water then travels back through the secondary mixing channel toward the center of the unit, over the second outlet weir into the secondary settling basin, in which the path of flow is identical to that in the primary basin. Conversion of the unit to single dosage and parallel flow is accomplished by removal of the channel bulkhead and by closing the adjacent weir openings with stop logs, so that the water may travel directly to the far end of the channel. At this point in each wall a large weir has been installed to replace the original 24 in. sluice gates. A simple adjustment of each baffle wall, made possible by a

free hinged end, has the effect of converting a portion of each basin into two parallel flow compartments. Experience indicates that the baffles in this position are desirable in that they assist in preventing transverse currents.

These simple alterations were carried out at very small cost and have had the effect of greatly increasing the efficiency and capacity of the whole plant, especially during periods of high turbidity.

Tests of normal operation this past winter showed that with a raw water of 1,000 p.p.m. turbidity, a clarification efficiency of 90 per cent was obtained in the primary unit, and 80 per cent in the secondary unit, making a total reduction of 98 per cent, resulting in an applied water turbidity of 20 p.p.m. The alum dosages in the two units were 4 and 2 grains per gallon respectively. Unfortunately, at this plant the total available mixing period at normal capacity of the plant is only 10 minutes. A longer period would undoubtedly produce a more rapidly settling floc with a smaller alum dosage. This fact is indicated by laboratory experiment and from our experience in operating the Upper San Leandro plant, where a mixing period of 25 minutes is provided. This latter plant has been in operation but little over a year. It was designed with the San Pablo experiences in mind and we are pleased to say that it is functioning excellently and in complete accordance with our expectations.

Circular Coagulation Tanks at Upper San Leandro Plant.—Circular coagulation tanks with mechanical stirring, used originally at Sacramento and in a slightly modified form at this plant, constitute perhaps the most interesting feature of design. These units differ from the Sacramento units more particularly in the matter of the ratio of paddle width to tank diameter. In the Sacramento design this ratio is 0.9, whereas in the Upper San Leandro plant the ratio is 0.24.

Paddles of this type have a lower starting torque and permit of much lower gear reduction. They are particularly well adapted to small units, since in these the paddle tip velocities are not excessive. Studies of these ratios with respect to hydraulic characteristics and other operating features are in progress and will be discussed in a later paper.

The high coagulation and sedimentation efficiencies at the Upper San Leandro plant are an important factor in reducing the burden on the filter units to a minimum. The average dosage of alum used at this plant for the entire first year of its operation was .89 grains per gallon as compared to 1.73 grains per gallon at the San Pablo plant. Applied water turbidities moreover were lower, averaging 10 and 15 parts per million respectively.

The mechanical mixing devices and exceptionally large waterways at the Upper San Leandro plant permit of a practically neglibible loss of head in the coagulation and sedimentation basins. Actual measurement at the rated capacity of the plant shows this loss to be only 1 in. The San Pablo loss of head with present baffling is 16 in., which at actual cost of pumping of 7 ct. per foot, per million gallons, would be $1.13 per day for the rated capacity of the plant. Electrical input at the Upper San Leandro plant for the four units is 3.6 hp., equivalent to $1.03 power cost per day also based on the same and actual rate for power. Although the costs are roughly equal, it should be noted that the mechanically operated units provide a retention period 2.5 times greater. Moreover, the mean velocities in these units are higher, averaging 1.3 ft. per second as compared to 0.8 ft. per second for the gravity mixing channel.

Chlorination.—All filtered water is chlorinated, primarily as a safety measure, because even the raw waters fall within the U. S. Public Health Service Standards throughout most of the year. The dosages vary from 2.5 to 8.5 lb. per million gallons and are controlled by frequent Tolidin tests. Our operators try to maintain between 0.50 and 1.00 lb. of residual chlorine per million gallons, ten minutes after application.

One ton chlorine cylinders have been in use since November, 1926, and we believe them to be the safest, cheapest and most reliable form of container for plants or groups of plants within a trucking radius of each other using a minimum of about 30 tons of chlorine per year.

Acknowledgment.—The above is an abstract of a paper presented at the San Francisco convention of the American Water Works Association.

Proper Disposal of Farm Sewage Important to Health.—Farmers' Bulletin No. 1227-F, entitled "Sewage and Sewerage of Farm Homes," reissued recently by the United States Department of Agriculture, warns against the dangers to human health and to livestock of negligence in properly caring for all forms of farm sewage. Details and illustrations are given for construction of approved privies, chemical closets and septic tanks. Suggestions are also made for the proper placing of them on farms so they will not drain toward wells. The use of disinfectants and deodorants is also explained. Proper care of the kitchen sink drainage is urged and illustrations show methods of disposal. The placing and construction of cesspools and grease traps are also discussed. Methods and details of construction are explained and illustrated in such a way as to be understood by homeowners. Copies of the bulletin may be obtained by application to the Office of Information, United States Department of Agriculture, Washington, D. C.

Pipe Line Inlet Air Valves

By J. W. LEDOUX
Consulting Engineer, Liberty Trust Building, Philadelphia, Pa.

In the July, 1926, issue of Water Works, the writer presented a paper on "Pipe Line Inlet Air Valves." Two very important experiences—one occurring in 1922 and the other during 1928—are convincing that there is a vitally important application of inlet air valves, or equivalent, that was not suggested in that paper.

The first experience was a number of serious breaks that took place on a 36-in. line, the cause of which was diagnosed as "water-hammer" due to a draft on the pipe line at a low point at a greater rate than the pipe capacity on the flatter grade above, causing the pressure on the flat grade to be reduced below the atmosphere, and the consequent parting of the column of water. When the draft on the line decreased, the upper column of water came in contact with the slower column of water in the lower part of the line, causing an enormously increased pressure, which broke the pipe. This experience was repeated five times within a year, and the pipe broke at different places not more than half a mile apart.

The remedy suggested was a surge tank at the point where the grade changed, and after this was installed no further breaks took place.

The writer was called in on a very similar experience in another part of the country where a 36-in. main had broken six times within four or five months. He diagnosed the cause to be the same as previously, and in this case, to avoid expense, advised combined automatic inlet air valves and outlet air valves. The first was to let in air as soon as the pressure was reduced to the atmosphere, which would provide an air cushion to prevent diastrous increase of pressure due to two columns of water coming together. The outlet air valves were necessary to relieve the line from air and permit the normal flow to be maintained.

This application of automatic inlet and outlet air valves is extremely important and they should be installed in a great many places where such conditions are possible, and may save the immense cost of surge tanks.

New York City Has 16 Garbage Incinerators.—New York now has 16 garbage incinerators in operation, located: three in Manhattan, two in Brooklyn, eight in Queens, and three in Richmond; three more are under construction in Brooklyn, and four more new incinerators were approved by the board of estimate and apportionment in November. It is expected that upon the completion of all—a total of twenty-three plants—the dumping of the city's garbage at sea may be entirely eliminated.

Cleaning a Water Main

Ice Plugs Used to Remove Soft Substance

By G. E. SHAW
Manager Chilton Hills Spring Water Co., Aylesbury, England

WHEN carrying out repairs or alterations on a public water supply system, the difficulties encountered are usually increased by the fact that, if the supply be curtailed, even to a slight extent, some of the consumers will lodge complaints. Perhaps, therefore, an account of a problem which had to be solved, without interfering with supply, by the Chilton Hills Spring Water Co. will be of interest.

Recently it became necessary to clean a length of 14-in. main which had become considerably choked by deposit. The main, which is shown in plan and profile in Fig. 1, runs from a service reservoir A to a point K, some 1¾ miles across country. All the water passing into the service reservoirs A and B is previously softened by Clark's lime process, and sometimes the water coming from the softening tanks is slightly grey, owing to the presence of minute particles of a flocculent nature. These particles, which have a specific gravity practically the same as that of water, remain in suspension in the water until they touch the walls or columns, when they appear to adhere to them tenaciously, but do not harden. The particles which are not arrested in this manner, enter the 14-in. main, and when they touch the sides of the pipes they adhere to them. In that way the main had become much clogged.

It was at first thought that the heaviest deposit was in the low-lying portion of the main, near the point F in the drawing, and in the hope of removing it, a wash-out had been inserted at the point K at the far end of the main. Although, however, that valve discharged the water faster than the main could bring it down, no great amount of deposit was washed through, which was taken to show that the deposit was in the upper part of the main, that is, between the points F and A, and that other measures would be required to remove it.

As a commencement, a 1-in. gas tapping hole was bored in the main at E, and on inserting a candle on a wire into that hole, it was found that the interior of the pipe was coated evenly all around to a depth of 2½ in. with a soft chalky substance.

It would, of course, have been possible to remove the deposit by means of the usual type of scraper, but there was hesitation in using a scraper, for, in the event of its sticking, the water supply of the whole system would have been cut off until it was removed. As the main was, in some places, as much as 16 ft. below ground level, it would have been a lengthy undertaking to open the ground and cut out the scraper if it happened to stick in any of those places.

It was therefore decided to clear the main by using plugs of ice which would melt if they did happen to stick. The main was, accordingly, cut at the points E and G, and a hatch-box was inserted at each place, a 14-in. valve being at the same time inserted at H. The point G was chosen for the insertion of a hatch-box, as it was a little way up a hill side, and, by cutting a channel at the lower end of the excavation, water and debris issuing from the hatch-box could be discharged into a valley at the foot of the hill, so that no pumping would be required to keep the excavation clear of water.

It may be explained that, before starting operations preliminary experiments had been carried out at the works with a short length of 10-in. main. A 10-in. diameter plug of ice, which had a 1-in. diameter hole formed through it from end to end, was employed. The 1-in hole was formed because it was thought that it would be necessary to have a flow of water through the plug so as to wash away the debris as it was scraped off the sides of the main. It was found, however, that the flow of water through the hole speedily melted the ice, so that the plug became disintegrated in traveling some 200 ft.

For the actual work of cleaning the 14-in. main, it was therefore decided to use solid plugs, 14-in. diameter, and they were made 4 ft. long. There was a doubt at first as to whether (a) the debris scraped off the pipe would pack in front of the ice block and choke the pipe if the block were allowed to travel too slowly, or (b) on the other hand, the plug would melt quickly if allowed to travel too fast. It was decided, however, that it would be safer to let it travel faster rather than slower; but, as an aid to keeping down the temperature, and lowering the speed of melting, about 5 cwt. of broken ice were inserted in the pipe from each end of the hatch-box E. A 14-in. plug of ice, 4 ft. long, was then inserted in the hatch-box and the cover put on. The valve H had been closed and the cover of the hatch-box G had been removed while the ice was being inserted.

In order to carry out the work of clearing the main at a time which would cause the least inconvenience, operations were begun late one evening when the demand on the system was low. The valve at A was therefore opened at 10 p. m. As a result, the plug of ice was driven through the main to the hatch-box—a distance of over 3,000 ft. —in 10 minutes. After the water had been allowed to run through the main for a further few minutes, it was shut off, a second plug was then inserted in the hatch-box E and the operation repeated, the valve A being closed after a 20-min. flush.

It may be explained that when the main was cut to insert the hatch-box G the coating inside the pipe was found to be 1¼ in. all around, but after draining the low part of the pipe by means of the scour valve shown on the drawing, an acetylene lamp, passed along the main on tubing from G in the direction of F, showed the black of the Angus Smith coating for 300 ft.—the furthest distance that the lamp could be passed up the main—which proved that, for that length, at any rate, the main had been effectively cleared.

At 11 p. m. the valve F was closed, ice was inserted at G and the wash-out valve K and valve H were opened. While that was being done the main between F and A had become charged to its full pressure. The valve F was then opened, and the ice and debris was flushed through the valve K, a distance of nearly 5,000 ft., and discharged there, the operation being completed at 12:30 a. m. The whole length of the main from the reservoir A to the wash-out valve K was, therefore, cleaned in 2½ hours.

On visiting the site next day it was estimated that about 20 cart loads had been discharged at G—of which 14 cart loads were actually scraped off the grass and removed—and from 6 to 7 cart loads had been discharged at K. Judging from the portions of ice discharged, the writer arrived at the conclusion that 4,000 ft. is the maximum length that can be efficiently scraped by means of ice plugs, but that it would be possible to scrape a longer length by using a plug made of sugar of a similar consistency to that of hard boiled sweets, which would take much longer to dissolve than ice would to melt.

Acknowledgment.—The foregoing is taken from the Dec. 28 issue of The Engineer, London, England.

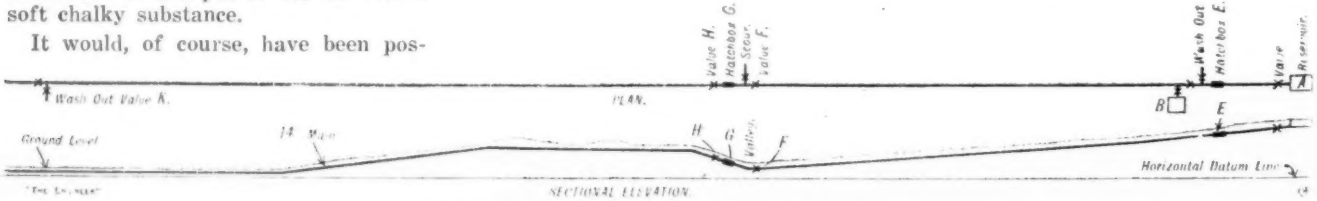


Fig. 1—Plan and Profile of Main That Was Cleaned

City Engineers' Problems Discussed at Cleveland Convention A. R. B. A.

Important Reports Presented by City Officials' Division

The Objects of the City Officials' Division

An Outline of What Is to Be Done

By CAPT. H. C. WHITEHURST

President City Officials' Divison; Assistant to Engineer Commissioner of Washington, D. C.

THE officials of the American Road Builders' Association, realizing the necessity for closer cooperation and greater standardization in the municipal highway field, organized on June 8, 1928, the City Officials Division. This division will doubtless fill the greatest existing gap in the highway industry.

It is through this division that municipal highway engineers will be afforded the opportunity to meet for an exchange of ideas and a study of new developments and methods. The advantage of conferring with manufacturers, contractors and others from every section of the country will be of inestimable value to all of us, and we trust every city official will endeavor to cooperate with us in our plan to improve municipal highway conditions.

It is my belief that every city should have a representative actively engaged in the work of this division.

Four Hundred Million Dollars Spent Yearly for New Paving.—The extent of the municipal highway activity is difficult to realize. No accurate figures as to the total yardage of pavements or improved streets covering all cities of the United States have ever been compiled. It has, however, been conservatively estimated that the total exceeds twenty billion square yards. Reports and estimates of new construction undertaken during 1927 indicate a total expenditure of over $400,000,000 for roadway paving, to which must be added $100,000,000 for maintenance. These figures do not take into account the expenditures for alleys, sidewalks, grading, roadway replacement and other municipal highway projects, such as street widening, bridges and grade crossing elimination projects.

Four General Committees.—The division has been organized into four committees for the work, as follows:

1. Organization, Administration and Finance.
2. Design and Construction.
3. Maintenance.
4. Traffic.

Each of these general committees has been divided into various sub-committees; however, for the first year, pending a survey of the municipal field and a broader acquaintanceship with those who will cooperate in the work, the general committee chairmen will develop the subjects for study by presenting at this convention an outline compilation of practices and thoughts for further study. The subjects under the several general committees cover practically the entire municipal highway and traffic field.

To me, however, under each of these committees there are outstanding features worthy of special consideration and thought mainly because of the past neglect, not only in the city I represent, in the city in which you are interested, but in 95 per cent of the other cities of the United States.

Organization, Administration and Finance.—Committee No. 1 deals with organization, administration and finance. I have found in my study of this subject that the methods employed in various cities differ to a marked degree. Of course, many of the methods are due to charter of state laws, and undoubtedly the systems in use serve in most cases, the purpose. There is, however, one neglected activity under study by this committee which is not controlled by basic laws and is vitally essential to the efficient and economical operation of any city street or highway department, no matter how organized or administered. I refer to cost records. You would be surprised to know that few cities of hundreds we have been in touch with keep any cost records, as we understand the term. Some have records of labor and material, but only a very few can give you accurate cost data of various operations. Without these, how can we compare methods, how can be say we are operating economically, or how can we be assured that we are getting the most out of our appropriations? Do we want to know? It may be like the man who owns an automobile; he doesn't want to know. Cost data are essential to the proper and efficient management of a municipal highway department; without it who can say when pavement and plant replacements are to be made or decide dozens of other questions? If such records were available over a period of years and the repairs of a certain kind were costing twice as much in Cleveland as in Chicago, your engineers would want to know why—without such figures, accurately and honestly made, we go pounding on in the dark. A uniform system is preferable so comparison may be made.

Such records would not only guide the engineer in maintenance work, but materially assist the designing and construction engineer in the selection and design of types of pavements.

Design and Construction.—Committee No. 2 deals with design and construction. Not to minimize the testing, research and experimental work that has been carried on in this field with inestimable value to every engineer interested in highway work, there is one, as important, but neglected subject assigned for study to this committee—field control and inspection. Associations, research bureaus, federal agencies and others have given us data for design and construction based upon scientific research and experiments that guide both the state and municipal engineer in the right path in this field; however, not one has put forward an educational campaign to insure the proper construction. Leaving for the moment mistakes in judgment and of sub-grade conditions, I dare say 90 per cent of other failures of streets and roads are due to poor inspections and lack of field control, or improper maintenance, the latter a subject I will touch upon. We carefully investigate the qualifications of applicant for design and field engineering positions, spend thousands of dollars in preparing plans and specifications, much time and thought in the testing and selection of materials, and then turn the work in the field for actual construction over to men who oftentimes fail to carry out either the spirit or intention of the work, either through incompetency or neglect. I have recently examined the paving specifications of some seventy odd cities. While there are provisions in some I do not agree with, there is not a single one if properly carried out that wouldn't insure a reasonable good pavement for the purpose intended. A relatively short time ago, I had the opportunity of visiting fifteen cities of the larger class and three state highway projects during the construction season. When I tell you that in eight of these cities there were no inspectors on the work, in four of them where inspectors were present they did not have nor had they seen the specifications, and in the remaining three, inspectors were present with the specifications but only two had read them, do we wonder why pavements fail. The state jobs were all well conducted with an inspector present and in each case he understood his work. These facts are almost unbelievable.

While I have for some time recognized the necessity and value of well trained inspectors, it so impressed me that I have given the subject since more thought than ever. Pavements are designed, specifications drawn and materials tested to provide and insure a predetermined strength in the structure. If construction is carried out in accordance with these instruments of service by the inspectors and engineers in the field, success will be attained in practically every case.

If men have to be employed in a city force for one reason or another, men untrained for the character of work in hand, incompetent or otherwise unsuited, don't put them in your inspection service, for if you do, the value of your engineers is partially destroyed and thousands of dollars invested in your construction jeopardized. Cities too small or whose work is not uniform so that they can maintain the nucleus of a good inspection force under a highly qualified chief inspector, would do well not to attempt to provide any inspection service but rather look to the established inspection bureaus for service, the services of which may be obtained at exceedingly low cost. Such service is vital to success.

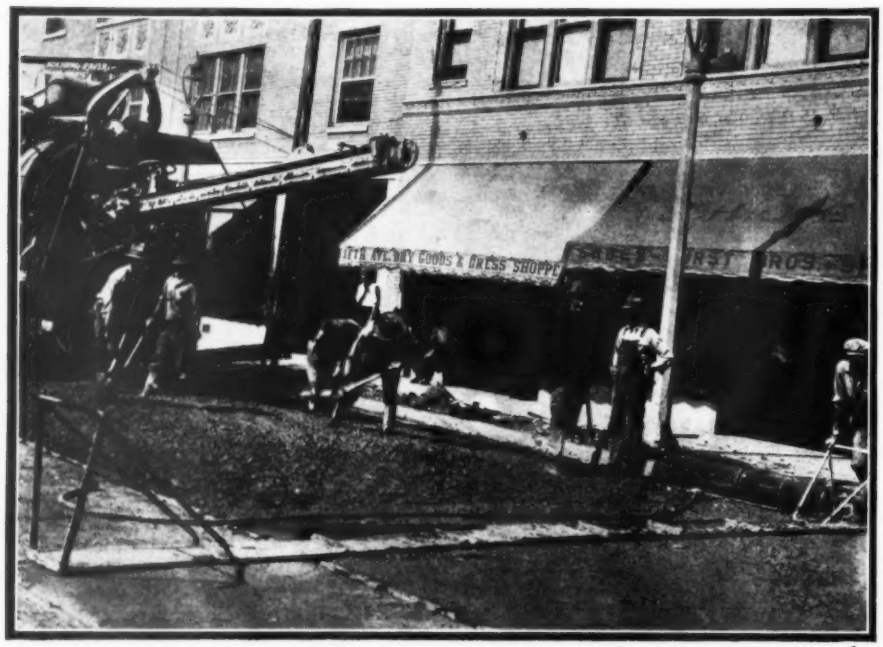
Street Maintenance.—Committee No. 3 deals with the important subject of maintenance in all its branches. I am not going to attempt to go into detail on the operation of a maintenance division of a highway department, but I do want to bring out the importance of the necessity of keeping our streets in a high state of repair at all times, such being in the end the far more economical plan as well as providing better and safer traffic conditions.

Systematic maintenance with well defined policies will pull us out of the holes and result in far more economic operation, to say nothing of the comfort and convenience of the public. It takes a systematic procedure, a well balanced organization and sincere efforts. Do we want it? Is it worth while? The replacement value of paving and accessories of improved streets of the cities of the United States amounts to many billions of dollars—shouldn't such an investment be protected by proper maintenance—should highway maintenance, the right-of-way of the public, be carried on in a systematic and efficient manner the same as our principal railroads practice?

It is my belief that if sincere field control and inspection together with systematic and efficient maintenance were practiced today, failures of pavements would be reduced 90 per cent and in a few years result in large economy to municipalities. We condemn pavement design and materials unjustly instead of facing and stating our honest belief. I know of one city that has increased both the richness of mix and depth of base of the concrete for asphalt tops each year for the last three, attempting to prevent failure. Do you think the failure is due to design? What does the inspection cost?—probably less than 2 ct. per square yard, yet without any hesitancy the cost is increased 20 ct. per square yard by a change in specifications while everyone fears to increase the cost of inspection 1 ct. to correct the evil.

Traffic.—Committee No. 4 deals with the problems of traffic from many different angles. As a highway engineer, I am primarily interested from the standpoint of the use of streets, their capacity both as to volume and loads. The impression I have gained from my study of the traffic situation as related to a highway engineer's interest is the entire lack in nearly all cities of coordination of highway, traffic and public utility interests. The works of one are constantly upset by the works of another. There must be a closer and more cooperative spirit developed among these municipal activities if we are to succeed in our ultimate goal of service for the public. A highway system of a city may be likened to a railroad system in many ways. Where the arterial highways and main thoroughfares correspond to the main lines, the local or residence streets to the branch or secondary lines and the dirt or unimproved streets to sidings. In a railroad system each is constructed and maintained for the service intended. Is not the same applicable to a city highway system? To accomplish this, however, cities must zone or designate the street for use, design and maintain them for the service intended. Cities like railroads cannot, if for no reason than economic ones, construct all lines for maximum service and traffic. It is also true that railroad authorities design for certain classes of rolling stock which they control. So it must be with highway engineers or still greater losses may be expected.

If the City Officials' Division can accomplish no more than work out constructive suggestions for the benefit of cities to bring about the proper cost records, improvement in inspection service, systematic and adequate maintenance and a closer relation between traffic and highway authorities, it will have not only fulfilled its purpose and duty to the municipal authorities but will be the means of pointing out the way of saving millions of dollars to the taxpayers throughout our American cities.



Organization, Administration and Finance

Preliminary Report of Committee Presented Jan. 15 at Cleveland

By H. C. WHITEHURST

Chairman Committee on Organization, Administration and Finance, City Officials' Division

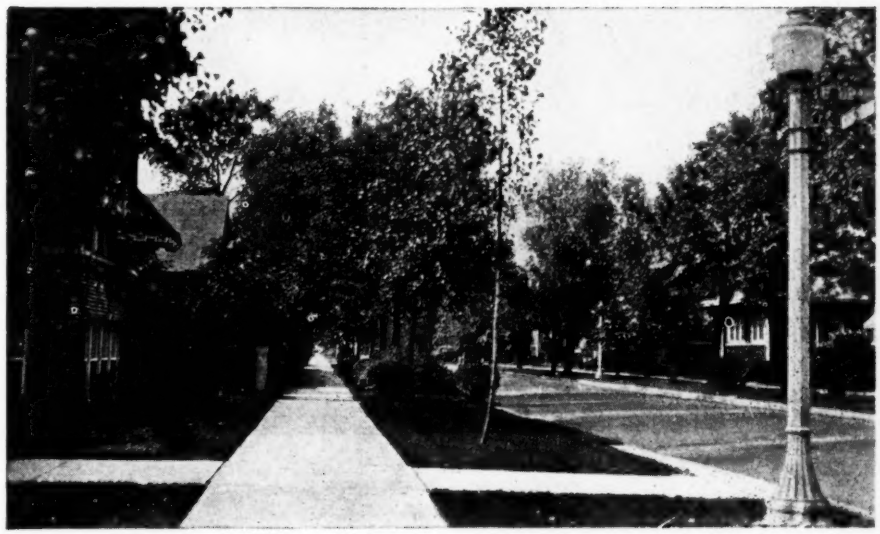
REPORTS, annual and special, were received from the highway departments of over sixty cities in the United States, and covered every state in the Union. They indicate many and varied methods of operation, administration, and financial procedure showing that to accomplish the same purpose there is no approach to standardization or the adoption of a uniform system. Due to this varying procedure, comparison is difficult. However, a compilation will afford a basis for discussion of the merits of the methods and will serve as an expression or guide to the sub-committees which may further develop the problem.

Six Major Subjects Considered.—The executive committee, after thorough study, tentatively divided the work of

the Committee on Organization, Administration and Finance into six major subjects as follows:

1. Organization.
   a—Cities of more than 300,000 population.
   b—Cities of less than 300,000 population.
2. Method of financing for new pavements.
3. Contract procedure.
4. Selection of types of paving and streets to be paved.
5. Financing and charges for street openings or cuts.
6. Cost records.

It is the intention of the executive committee to later develop each of these subjects through sub-committees, and to add other subjects which appear desirable.



Organization.—The organization of the highway departments of the sixty odd cities studied, indicate varied and detailed methods of control and organization. Generally speaking, their entire highway activities are centralized under one coordinating or directing head who is charged with full responsibility for administration, design, construction, maintenance and inspection. On the other hand, in some cities of the first rank, there is a division of authority and responsibility. In these, design and construction are under one chief and maintenance is under another, without a supervising and coordinating head over both. In this latter class of decentralized control is one of our larger cities, which has separate and independent boards; one controls construction and the other controls maintenance. The law under which the maintenance board operates prohibits maintenance repairs to more than 15 per cent of the street area. Consequently, if maintenance funds are not readily available the street is neglected until 15 per cent or more of its area is in need of repair. It then automatically becomes the burden of the board on new construction. As a consequence many streets with several years of life and which are worthy of economical repair are left to go to pieces until new construction can be undertaken.

Organization detail in cities must necessarily vary widely due to local laws and conditions. The work of construction and maintenance is so closely related that a division of authority cannot be economical or efficient regardless of the size of the city. While the resurfacing of an asphalt street by stripping the base or by the super heater method may be primarily called a maintenance operation, the construction division is usually better equipped to handle such operations. Many conditions could be cited to illustrate the desirability of and necessity for both branches reporting directly to a common active head.

Many cities while reporting the design and construction division as one, seemingly divide these functions. The peculiar operation of this division in the highway department of the District of Columbia may merit your consideration. The engineer in charge of the division of design and construction, in addition to his assistant construction engineer, is supported by nine assistant principal engineers, each in charge of a designated character of work. The assistant engineers are responsible for and execute the design of their own field work under the supervision of the assistant engineer of construction. They are responsible for design, field layout, co-ordination and general supervision. This organization has been found to operate satisfactorily by centralizing responsibility for results and progress.

Few cities attempt to maintain, as an independent unit of the highway department, an inspection division. Most cities, of any size, necessarily provide for inspectors in their organization but usually place them under the construction engineer in charge of the project. My study of this highly important phase of our work and organization has convinced me of the necessity in cities of sufficient size for an independent unit under a chief inspector who is responsible only to the bureau chief. Construction engineers, while interested in quality, are chiefly concerned with grades, progress and the like, while the inspector is or should be interested above all other things, in quality and compliance with the plans and specifications.

If a city on account of its size or the amount of work being performed annually cannot justify qualified annual inspectors, the employment of the services of an organized and qualified inspection bureau is necessary and justified. Without proper field control, inspection of materials, engineering and design goes for naught. Field control is the heart of your work, if it is inadequate failure is inevitable.

The organization charts of the highway activities of three cities are presented to show some of the variations in organization:

No. 1—A city of 200,000 population.
No. 2—A city of 500,000 population.
No. 3—A city of 1,100,000 population.

Method of Financing for New Pavements.—The usual procedure of financing for new pavements is through special assessment and bond issues. Local streets are financed by the assessment method and main arteries by bond issue, followed in some cases by partial assessment. Only in rare instances do cities report direct appropriation followed by assessment. This latter method is followed in the District of Columbia and reacts with great favor to the highway department, whose work for the season can thereby be well planned in advance. In new sections a great deal of paving is undertaken by private parties under the whole cost method; the work being performed under permits issued by the engineering department, which require that the work be carried out under current specifications and district inspection.

In the matter of special assessment for street improvements, in spite of its importance, very little study has been given to the subject; consequently there is little uniformity or standard procedure.

A study of assessment procedure based upon reports from twenty-six cities having each a population of 100,000 or more shows the following methods:

New Street Paving.—The method most used is the 100 per cent assessment of abutting property by the front foot. In some instances this method is not completely used as intersections and other exceptions are made. In ten cities paving costs including intersections are assessed. In eight, the paving, except intersections, is assessed. In two, the city pays for intersections plus 2 per cent of the remaining cost. In two, the assessment is to the extent of actual benefit and the remainder is paid by the city. In one, the abutting property is assessed for a 12ft. strip, the balance,

including intersections, is paid for by the city. In one, parkways and special traffic streets are paid for entirely by the city; on other streets the abutting property pays 100 per cent, less intersections. In two, assessment is based entirely upon character of street, varying from 20 per cent to 100 per cent.

Eighteen cities of those studied assess benefits on the front foot basis, one on the area basis, three use zones, and two a combination. In several cities, property on the intersecting streets for a part of the block, are assessed.

Washington's method is based upon the so-called Borland Amendment passed in 1914, which requires street paving to be assessed once only. Fifty per cent is assessed against the abutting property owners (25 per cent on each side) up to a width of 40 ft., less all intersections, and the balance, including intersections and widths in excess of 40 ft., is paid by the city.

Sidewalks.—In practically every city the entire cost of sidewalks is assessed against abutting property. In Cleveland and Philadelphia sidewalks are constructed and paid for by the property owner. In Washington 50 per cent of the entire cost is assessed (whole cost sidewalks are permitted when laid under district specifications and supervision).

Grading.—In fifteen of the cities studied, the cost of grading is assessed by the same method as paving, or included in the paving cost. In one, however, only sub-grading is included and general grading assessed against a benefit district. In ten cities, original grading is assessed either by assessment against abutting property or a benefit district created for the purpose. In two, one of which is Washington, there is no grading assessment.

Curb and Gutter.—In practically all cities the assessment for curb and gutter follows the paving assessment procedure.

Repaving.—Sixteen cities assess the same as for original pavements, however, some add special provisions as to age when replaced. Five cities make no assessment for repaving. In one, there is no assessment for repaving, if pavement is less than 15 years old. In one, cost of assessment is limited to $3 per yard. In Cleveland, the assessment is for 50 per cent of the cost. In one, two-thirds of the cost is assessed against abutting property. In one, one-half, and in one, one-fourth.

In Washington, pavement assessment can be made but once. Prior to 1914 there was no assessment. As the pavements so far replaced were laid before 1914, assessments are made as streets are repaved and at the same rate of assessment as for new pavements. If it is desirable to surface a street paved with concrete or block, and which had been previously assessed, the property cannot again be assessed. In the case of all street improvements, except paving of roadways, the law provides for advertisement for objection at a public hearing of abutting property owners. The board of commissioners determine after a hearing whether or not to overrule any objections and order the work to proceed in the interest of the public.

It appears that all cities use assessments in one form or another and that the usual manner of payment to the contractor for the work done is by one of two methods:

(1) By certificate of assessment, in which case the contractor assumes the responsibility for collection and suffers any loss of those that are uncollectable.

(2) By cash. The city obtaining the necessary funds partly from property owners, who pay when the work is completed, and partly from the sale of assessment bonds. Bonds are liens against the property, some cities guarantee them; some do not.

(Washington pays by cash appropriated directly by Congress. The cash funds are obtained from general taxes and the gasoline tax.)

The first method which is practiced in a great many cities where the 100 per cent assessment plan is used undoubtedly encourages and necessitates the contractor to increase his unit bid to cover anticipated losses.

The assessment for street improvement as applied to roadway paving was practiced years ago as a purely local benefit. When the laws were written undoubtedly such was the case, but today, except in the case of purely local residence streets, the extent of the local benefit is doubtful. Conditions, since the original assessment laws of most cities were passed, have materially changed. Roadways are designed and constructed today for general traffic requirements and only in a small part as local benefit. If our assessment laws are out of date, the time has arrived when a larger part of the pavement cost should be passed on to the user and the property owner relieved of some of his burden.

Contract Procedure.—Applying the term "contract procedure" to mean the method of letting contracts for street improvements, it is found that cities utilize the same general policy of letting a separate contract for each street whether the work is for one block or more. Several streets may be included in one letting but separate contracts made for each. This procedure is undoubtedly made necessary in many cases by law, but it involves enormous clerical and other work, judging by the number of contracts in each city during one year. In cities over 300,000 population, where considerable work is undertaken each year, the number of contracts for street improvements vary from 94 to 997. In cities with a population of 100,000 to 300,000, contracts vary in number from 21 to 180.

In Washington the system is so entirely different from other cities that it may merit your interest. Bids are invited at the start of the working season, usually in March, for each class of work. Projects are advertised in groups of sufficient size to constitute a season's work, except that a few minor contracts are made from time to time. Some of the contracts require completion by December 1 and some require a percentage of completion on that date. The balance of the contract being completed during the following spring by June 30, the end of the fiscal year. The exact dates are determined by our ability to pay and the size of the contract. The specifications are issued stipulat-

ing the amount upon which bids will be scheduled. The statement is included that a list of streets from which work will be allotted the contractor is on file for his examination in the engineer of highway's office. The system has proven successful and has resulted in low bid prices as compared with those of several other cities. This method also insures continuous work during the working season and attracts contractors who have adequate organizations and equipment.

The qualification of bidders and contractors for executing important highway and street improvement in cities should receive the serious consideration of the sub-committee on contracts. The pre-qualification of bidders is practiced in some states while in others contractors are required to present satisfactory evidence of adequate experience, financial resources and equipment to execute the work successfully. Cities would do well to follow, in part at least, the requirements made by our states.

Selection of Types of Paving and Streets to be Paved.—The selection of the character of paving for various projects, certainly in all of the larger cities, is based almost entirely on traffic requirements. Generally speaking, the types, without reference to the design, have been generally standardized. Exceptions are the local or unimportant streets and the reclaiming of existing structures.

The procedure of selecting streets to be improved is similar. Cities follow practically the same course, namely, the improvement of main arteries and thoroughfares are selected by the board of improvement and the local streets are selected after reviewing requests and petitions of property owners and others.

Financing and Charges for Street Openings or Cuts.—The charges to public utility companies and others for repairing cuts or openings in improved streets are made on both the flat rate system and the cost plus system. Some cities use both. Washington, for example, is in the latter class and uses the flat rate based on published charges for replacing all existing types of paving and sidewalks when the area is less than 10 square yards. The cost plus system is used when the erea is in excess of 10 square yards. The percentage added where the cost plus system is used varies from 5 per cent to 15 per cent. Nearly all cities require a deposit in advance of permit. The whole subject of cuts, including replacement and repairs, is one in which all cities are vitally interested. I believe it merits the appointment of a special committee to study and report in detail on financing, charging, methods, repairing and inspection.

Cost Records.—Few cities keep or attempt to keep any detailed cost data. Some have records of labor and material, but only a few can give accurate cost data for various operations. Even those that attempt any system of accounting procedure are so vague as to details included in ascertaining the cost, that the reports are of little value. Cost data is essential and indispensable to the proper and efficient management of any municipal highway department. A uniform system of accounting would make comparisons possible, which would lead to more effective management and standardization of principles of operation.

In connection with keeping cost data as applied to roadway repairs it would be decidedly advantageous to have a corresponding record of area repairs, exclusive of cuts, for each type of paving.

In reviewing the subjects assigned this committee I have reached the conclusion that organization and selection of streets to be paved, are problems for the individual cities. Further detailed study will accomplish little but to furnish interesting data for comparison. The matter of assessment or financing for new pavements, contract procedure, financing and charges for cuts, and cost records, are in my judgment worthy of close study and investigation by subcommittees, one for each subject. An exhaustive investigation and study of the various practices followed by a report with specific recommendations will be of inestimable value to all city highway officials.

Pavement Design and Construction

Preliminary Report of Committee Presented Jan. 15 at Cleveland

By GEO. B. SOWERS

Chairman Design and Construction Committee; Deputy Commissioner of Engineering and Construction, City of Cleveland, O.

MANY millions of dollars are spent each year, by the cities of this country in the construction and maintenance of pavements, more money than is spent in any other one municipal enterprise. This tremendous expenditure is prompted and justified by the health and pleasure of the people and the economic demands of business. A city must provide and maintain a pavement in every street.

Much of the city paving work is still in an experimental stage. New designs, methods and materials are being adopted in different places without taking advantage of the experiences of other cities. Experience is expensive, and requires years of time to be acquired. No one city official has the time or facilities to gain personal experience on the service and merits of all the paving designs, or methods and materials which are available.

What better way is there for obtaining the accumulated experiences of many cities than through the work of the design and construction committee? Cannot our greatest service be through the accumulating and disseminating of the paving experience of cities? Factors of size of city; climate; kind of subgrade; the variety of machinery; the quantities and size of materials used, all offer most valuable fields of study.

The executive committee therefore thought it best to present a tentative outline of such a study as a basis for work during the coming year. There are no findings or conclusions in my report, but only suggestions which will be still further enlarged, I hope, by discussion. The executive committee has divided the tasks of the design and construction committee into seven major topics:

I. Contracts and Specifications.
II. Roadway Widths.
III. Subgrade.
IV. Pavement Bases.
V. Wearing Surfacing.
VI. Street Railway Tracks and Paving.
VII. Field Engineering and Inspection.

Let us take up each in turn and see what possibilities can be developed.

Contracts and Specifications.—First let us consider contracts and specifications because they offer an unlimited field for study.

I have found the standardization of specifications very interesting and profitable. Standardization and simplification of specifications will bring about the elimination of economic wastes, and permit the producers of paving materials to lower the selling price of their product through a reduction in manufacturing costs. They also allow the manufacturers of road building equipment to reduce the number of sizes of equipment, and thereby lower their costs. Standardization and simplification will therefore lower the final cost of the pavement to the public.

In the Cleveland metropolitan area there are a large number of independent municipalities. A few years ago it was realized that the same paving contractors and material dealers served all of the municipalities under many different specifications. At the instance of Mr. Hopkins, our regional vice-president and the city manager of Cleveland, the engineers representing the Cleveland metropolitan area met and adopted a uniform set of paving and materials specifications. These standardized specifications have proven to be very advantageous.

There are a great many national associations and boards working upon the standardization of paving materials. As the requirements for materials become standardized throughout the country, the combining of these ma-

terials into a pavement can be standardized.

Standard specifications advocated by an association such as ours, should be so prepared that each engineer can adapt them to his peculiar conditions.

Competition is an essential requirement in all specifications issued by municipalities. It is generally prescribed by law. How can paving specifications be written to use the new patented materials and processes, and at the same time permit competition?

The contract form and general provisions, as well as the more general part of the specifications are not well adapted to standardization. State laws, municipal ordinances, and local practices govern these features in each municipality.

Progress towards standardization will be slow and we must not expect too much this first year.

Roadway Widths.—Roadway widths are probably a function of city planning, but they generally are determined by the city engineer. If the street right-of-way is wide there is always the opportunity to use a liberal roadway width. Many of our street rights-of-way were fixed before the era of motors, and the paving engineer is limited to the width of the roadway that he can crowd into the existing right-of-way and still leave room for a sidewalk of reasonable width, together with a space for poles and fire hydrants.

In a city such as Washington, the roadway widths may be made more generous in order to carry out the picture of spaciousness, but in cities such as Philadelphia, where land is very valuable, the right-of-way is made the narrowest permissible, and the paving engineer must plan the pavement width with the greatest care.

On inter-city highways the general rule for fixing the roadway which seems to be 10 ft. of pavement for each line of moving vehicles, and 8 ft. for each line of parked vehicles. Does this same rule apply to the main traveled business streets of our cities where traffic naturally moves more slowly, or can a narrower width of lane be used with safety?

The width of traffic lanes around curves should perhaps be given study. The theoretical additional width required for a turning vehicle can easily be determined, but the proper allowance that should be made for the inability of drivers to keep within the curved lines of a traffic lane apparently has never been determined.

Subgrade.—The subgrade is one of the most popular paving subjects today. The study of soils in pavement subgrades is intensely interesting because of the great variety of soils and the many possibilities for improving the unsuitable ones. Subgrade soils range from the most perfect sand soils to the worst clay, silt or muck.

Each unsuitable type of soil requires a different treatment to meet different kinds of climatic and pavement conditions. As yet no certain rules have been found which will apply in every case. Much work has been done in the United States Department of Public Roads and the results of some of their studies will soon be published. Wonderful progress in soil investigation is being made in some of the state highway departments, but little study has been given to the subgrades in cities.

Instead of continuing to build thicker and stronger pavement bases in an effort to carry the increasing traffic loads over more or less unstable subgrades, it is more logical and economical to increase the supporting power of the subgrade. No economical thickness, or strength, of plain concrete will carry the loads of traffic over a subgrade which becomes unstable under certain climatic conditions. The only reasonable solution of this problem is the increasing of the supporting power of the subgrade.

The subgrade material in the City of Cleveland ranges from perfect sand to clays that heave and lose almost all of their supporting power at certain times in the year. In the clay areas of Cleveland the supporting power of the subgrade is being economically increased through the use of a 4-in. cushion blanket course of granulated slag under the concrete base, with plenty of drains to take the water from the porous layer. The past year has been the third season that this porous sub-base has been used. It has overcome considerable cracking of the surface and the pavements are carrying the maximum loads without failure.

The granulated-slag cushion blanket course has a tendency to cement together, forming not only a porous insulating layer, but also adding greatly to the strength of the pavement foundation.

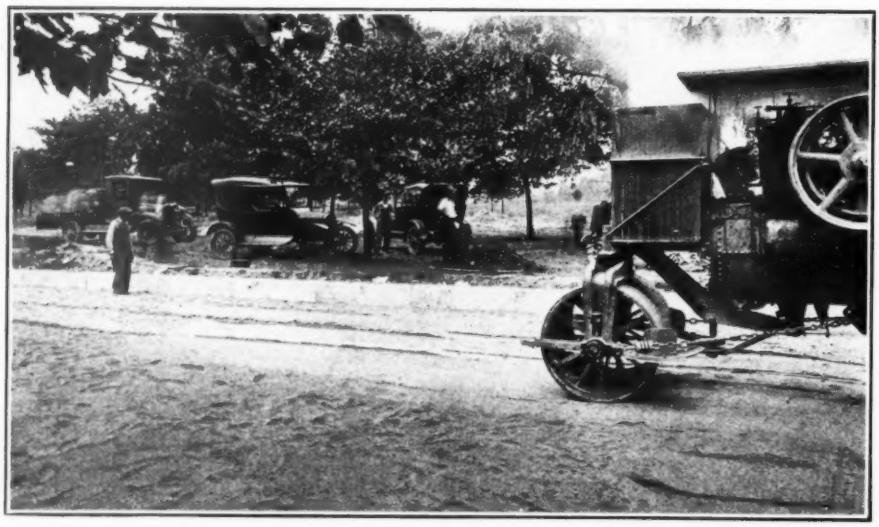
The compacting of the subgrade prior to paving is another of the subgrade problems. Should not the soil under a pavement be left or placed in its natural condition, if it is to provide a uniform bearing for the pavement? If over compact, it will expand to its natural condition in the course of time and raise the pavement, and if undercompacted, it will gradually consolidate and settle away from the pavement foundation.

Some engineers believe that the subgrade should be rolled with a 15-ton roller, while others require only a 5-ton roller. The heaver roller finds all the soft spots and uncompacted trenches in the subgrade, but it may over compact compressible subgrades in spots. The result is that the subgrade material expands to its natural condition in the course of time, causing unequal support under the pavement foundation.

It frequently happens after the subgrade is fully prepared to receive the pavement that it is cut to pieces by the trucks hauling the concrete aggregate or the mixed concrete. This damage has been overcome in Cleveland by the requirement that no trucking shall be allowed directly upon the subgrade or cushion blanket course. Trucking is permitted only upon a plank roadway or equally effective method for distributing the load.

Pavement Bases.—Pavement bases cover a large field for study. The thickness of the concrete base for various kinds of surfaces and assumed load conditions is worthy of considerable study.

Many engineers believe that a concrete having a 2,000-lb. crushing strength is the most economical for pavement bases; others claim that cement should be added to produce a concrete having a 3,000 or 4,000-lb. crushing strength. If it is only a question of additional density or of waterproofing, the same results might be obtained through a waterproofing of the concrete, instead of using a mixture which is richer in cement and which therefore expands and contracts to a greater extent.



A 4-in. Granulated Slag Cushion Blanket Course on East Boulevard, Cleveland

The city of Cleveland's specifications produce a concrete having a crushing strength of between 2,500 and 4,500 lb. per square inch at 28 days. This is probably 1,500 lb. higher than was used 10 years ago. There is some question as to whether or not the resulting increased coefficient of expansion is the cause of many of the broken places in the pavements.

In some parts of the country, macadam pavements have been used quite extensively in city streets. The old macadam pavements have been resurfaced with bituminous mixtures and the resulting surfaces in many cases are highly satisfactory. There is no doubt a field for the use of macadam bases under bituminous wearing surfaces, but all the facts are not known.

Some study should also be given to the use of such foundations as black base, and the natural sand bases.

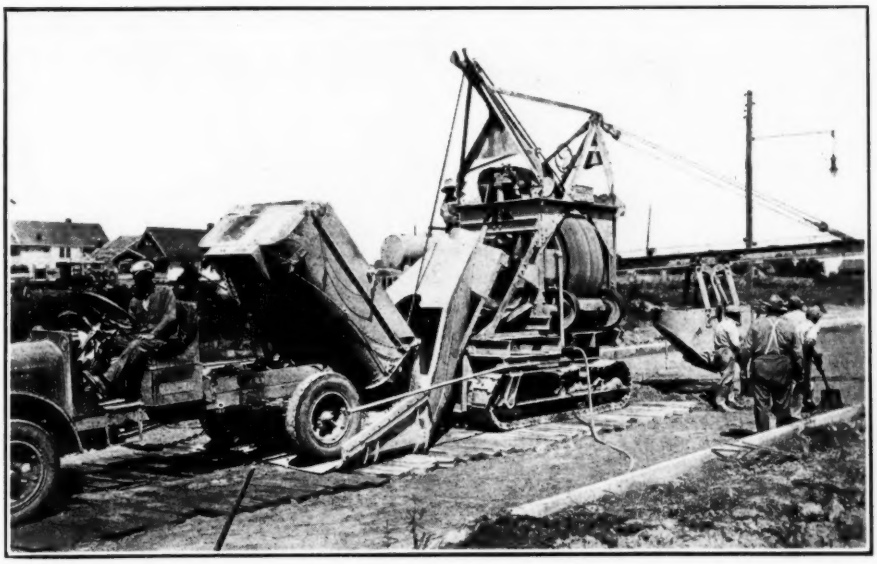
The Highway Research Board found that wire mesh reinforcement is advantageous in concrete roads because it reduced the width of cracks. Wire mesh reinforcement would probably be of value in pavement foundations. The city officials' division will make a comprehensive investigation of the question of pavement foundations, including the use of wire mesh reinforcement. Mr. Hogentogler of the Bureau of Public Roads, who conducted the survey on the use of reinforcement in concrete pavements, has consented to undertake the study of pavement bases. He is prepared to give a large amount of his time to this investigation.

The drilling of cores from pavement bases is a comparatively recent development. There is still much to be learned. Many city engineers do not believe that it is necessary, but Cleveland has found that it results in better and more uniform concrete foundations, both in thickness and strength.

Individually the cores drilled from pavement bases prove nothing, but collectively they give a good indication of what might be found if the entire base could be taken up, measured and tested. It is true that one little core taken from a length of pavement is a very small part of the whole, but obviously it is impracticable to examine the entire pavement base.

I believe that this committee can render a valuable service to the city engineers through the working out of a standard method for checking and testing the strength of concrete bases. All engineers desire uniform thickness and strength of the concrete, but they have not developed satisfactory methods for checking these items. Cores drilled from the pavements greatly assist in the solution of these problems.

The proportioning and grading of the concrete mixture and the consistency and workability of the concrete can all be more easily controlled at a central mixing plant. The resulting concrete has a more uniform final strength. There is also the possibility that the transporting of the concrete results in the elimination of air entrained in the concrete. This fact may account for some of the additional strength shown by the ready-mixed concrete. Warm concrete for use in cold weather construction is accomplished more easily with ready-mixed concrete than with concrete mixed on the street. Specifications should be developed to permit and control its use.



Planking on Subgrade on West Avenue, Cleveland

Many of the methods adapted to the curing of concrete roads in rural sections cannot be used in city streets. Ponding, earth covering or straw covering are some of the methods not practical in cities for obvious reasons. Sprinkling with water is probably the most common method used. Sodium silicate, asphalt spray and calcium chloride are being tried. Data and specifications for the use of the various curing methods would be welcomed by the city engineers I am sure.

Wearing Surface.—The wearing surface of pavements offers another unlimited field for study. The Bureau of Public Roads has found that the function of the top layer or wearing surface is to take the wear and absorb a portion of the impact from moving loads. Smoothness without slipperiness is one of the essential qualities of a wearing surface.

Time is an important factor in the paving of most city streets. Wearing surfaces which can be laid and opened to use in the shortest possible time have decided advantages. The minute a pavement is completed the public demands that it be turned over to them for use. The closing of one block in a built-up city means congestion in all adjoining streets, with a subsequent loss of business, and an increase of traffic and fire hazards.

The increase in the use of asphalt as a filler for block pavement surfaces has brought the problem of how to keep the asphalt from forming an unsightly and rough surface on the pavement during the first year after it is laid. Some asphalt fillers also become very sticky during warm weather. There are also asphalt fillers which become brittle and pull away from the blocks when the surface contracts, thereby defeating one purpose of an asphalt filler, namely, that of flexibility.

A non-skidding surface is one of the most desirable features of a pavement. Stone, vertical-fibre brick and some bituminous concretes present excellent non-skid surface. A cold-laid asphaltic mixture is being tried in the Cleveland area on hills having as high as 6 per cent grades.

The low annual cost and the ease with which it can be opened and replaced makes the sheet asphalt pavement surface very desirable for use on wide, heavily-traveled city streets.

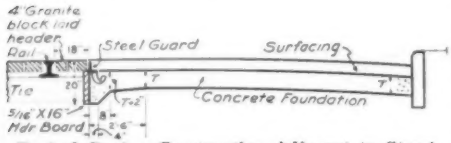
The plain and reinforced concrete pavements have proven very economical on rural highways. The use of concrete as a city pavement has not been as well developed. The finishing machines which have been so successfully used on rural highways have not been perfected for all classes of street paving, with the result that much of the finishing must be done by hand with consequent unevenness and over or under compacting and finishing. Study by your committee could do much to perfect the design and construction methods for concrete pavements.

Brick or stone-block gutters are used in many cities in combination with asphalt surfaces. There is some question as to whether these gutters are necessary or justified from the standpoint of cost. Some engineers claim that it is cheaper to use brick or stone gutters than to replace disintegrated asphalt gutters with new asphalt.

Street castings, manhole tops, valve boxes and catch basins are pavement details which require study and stand-

ardization. The improper setting of these castings results in holes and bumps, too many of these castings are designed solely from the standpoint of the public utility with no consideration given to the paving. We are very careful to obtain a smooth pavement surface, yet many city pavements are filled with street castings, each making a bump which is as undesirable as a hole in the pavement surface. The breaking of manhole and catchbasin tops is a continual source of damage claims in cities having heavy concentrated loads passing over the streets. Considerable study could well be given to the standardizing of street castings, their design and construction.

Street Railway Tracks and Paving.—The paving of the street railway tracks is closely allied to the construction of



Typical Paving Construction Adjacent to Street Railway Tracks, Cleveland

the tracks. Studies of track construction are being carried on by the American Railway Association. It is possible that the work of this division can be coordinated with the study being made by the railway companies themselves.

Considerable difficulty has been experienced in maintaining the roadway pavement outside the track area because of the vibrating and moving of the track construction. The edge of the pavement adjacent to the street railway track probably receives the heaviest traffic of the entire roadway. To compensate for the lower strength of the edge of the concrete pavement base, it has been found desirable, in Cleveland, to thicken the edge of the roadway slab adjacent to the track construction. It has also been found desirable to make a complete separation between the roadway pavement and the track construction, in order that the renewal and repairing of the track might not undermine the edge of the pavement or cause the paving surface to unravel. The present paving construction of the City of Cleveland now provides that a concrete beam shall be cast integral with the pavement base adjacent to the ends of the ties. The beam extends below the subgrade of the track pavement. The pavement surface is supported by a metal curb, which is built into the concrete base.

A number of materials have been used for pavement surfaces within the street railway tracks in Cleveland. The greater portion of the recent construction has been grout-filled granite blocks. Where the railway tracks are new and solid asphalt has proved satisfactory. Some concrete and brick paving has also been used.

Field Engineering and Inspection.—Finally, unless the field engineering and inspection follows a uniform interpretation of the standard specifications, the purpose of standards is only partially accomplished. Much good could be secured through the preparation of a standard manual of instructions and interpretations for the use of field engineers and inspectors.

The City of Cleveland has a manual of instructions for the use of its district engineers and inspectors. The city's contractors are assured of uniform engineering and inspection requirements whether their work is in one part of the city or another.

The form of the field organization in any city is largely determined by legal requirements and by precedent. Changes in the form of the organization can be made but slowly. It would probably be of value to city officials if they knew more about the form of field organizations in other cities. Such data could be collected and prepared in tabular form by your committee.

The use of full time, all-year-around inspectors, is very desirable from the standpoint of paving construction, but it brings the greater problem of how to pay and where to use this large group of men during the winter season. Perhaps some other city has solved this problem and your committee can learn of the solution.

Street Maintenance Committee Report

Committee Report Presented Jan. 15 at Cleveland Convention

By MAJOR C. E. MYERS
Chairman Committee on Maintenance; Director of Transit, Philadelphia, Pa.

IT is contemplated at this time to divide the maintenance committee into eight sub-committees, as follows:

1. Pavement Bases.
2. Concrete Surfaces.
3. Bituminous Surfaces.
4. All Types of Block Pavements.
5. Street Openings or Cuts.
6. Street Cleaning.
7. Resurfacing and Salvaging of Existing Pavements.
8. Unpaved Streets.

This first report of the general maintenance committee plans to touch briefly on the proposed work of each of the subcommittees. It does not contemplate making recommendations, but plans simply to state briefly the present status of the various kinds of work and the normal methods of procedure now in vogue in various cities. When it is realized that nearly twenty-five and a half million dollars is spent annually on maintenance alone, and largely by forces employed directly by the City, in some three hundred and twenty-six cities that have been tabulated, the importance of this subject may be grasped.

The work of a maintenance committee differs somewhat from a construction engineer's work. The maintenance end of the proposition does not advocate changes of types of paving, but must take what it finds, having inherited all kinds and all types of bases and surfaces. Its problem is to present a method of making repairs to its inheritance, whether or not the committee enjoys or believes in what it has inherited.

Pavement Bases. — Maintenance of pavement bases consists in most cities of making repairs to existing concrete bases. There are, of course, some old broken stone bases and some bituminous bases, but the larger quantity of the present street bases throughout the country appears to be concrete. Rigid type bases are found to exist varying from 5 in. of a 1:3:6 mixture up to extreme cases of 10 in. of a 1:2:4 mixture.

Repairs, generally, are made by maintenance forces directly in the employ of the municipality. Some cities have portable units, and make the repairs and mix the concrete on the street; other cities use pre-mixed concrete or wet batches for maintenance repairs. Some cities use an admixture in their concrete in order to close their openings as quickly as possible; others use a foreign fast-hardening cement and some an American fast-hardening cement; still others use a richer mixture for their repair work than was in the original base. There seems to be no uniformity in this field, each municipality being more or less of a law unto itself.

Concrete Surfaces.—As far as municipal work is concerned, with the exception of Seattle, Wash., and Washington, D. C., very few cities have adopted a concrete surface for city pavement work, owing, in general, to the difficulty in making repairs. The city of Washington, which probably has the largest yardage of concrete surface pavement to maintain, repairs entirely by city forces. They operate a concrete repair gang which is organized as a mobile unit and mix their concrete at or near the point of deposit. They maintain another gang exclusively for the pouring and sealing of cranks and joints. Throughout the country the general method is to make the repair of the same material and the same mixture as the original surface.

Bituminous Surfaces.—Repair work to bituminous surfaces, which, in the case of most cities, means sheet asphalt pavements, is taken care of almost universally in the larger cities by municipally-owned asphalt plants, and the material is laid by city employees. There are, of course, some exceptions to this rule. Some cities have annual contracts for asphalt repairs. The contractor is required to make the repairs not to exceed a total annual established yardage when and where desig-

nated by the engineer. Some cities also use small portable units for making their repairs.

Repairs to other types of bituminous surfaces are made in general with two types of material commonly known as "hot mix" or "cold mix." Under each of which sub-divisions there are a number of established methods.

Bituminous surface treatments are usual practice on the various macadam types of paving which are found in the outlying sections of the smaller cities, and sometimes very generally throughout the smaller cities. Again there are two general types of treatment—the hot and the cold application.

All Types of Block Pavements.—The general types of block pavements are wood block, asphalt block, vitrified block and stone (including granite) block.

Wood block has found but very little favor in city paving work in the past few years, and is rapidly being replaced with other types, quite frequently by the city maintenance forces. It is a very difficult pavement to maintain, as it is difficult to replace a small area because of the uneven wearing of the wood block.

Asphalt block has, in general, been unsuccessful, except in certain locations on wide streets where the traffic is well distributed. Like wood block, this material is very difficult to maintain because of the replacement. In many cases it is being replaced by another type of surfacing, usually by sheet asphalt. Asphalt block, however, is a convenient type to maintain in the small town that is not equipped with an asphalt plant.

Vitrified block at one time was used, especially in the smaller cities, almost exclusively, then fell into disfavor owing, generally, to inadequate bases. It is now rapidly returning to its proper field supported by an adequate foundation. It is a very easy type of pavement to maintain. Work can be handled with small gangs and small areas adequately patched. The older types are found with a sand filler; the more recent ones with a portland cement grout filler; and the very latest almost exclusively with a bituminous mastic filler.

Granite block has been and always will be the most nearly perfect surface for heavy traffic streets, especially on narrow width streets which are subject to tracking or rutting. Its expense, however, prevents quite frequently its use where conditions really warrant it. Its maintenance is very easy and simple, and replacements can be made in small areas, which is a distinct advantage. Like vitrified block, it is found in older cases on a sand foundation with a sand filler. The more modern pavements are either portland cement grout or bituminous mastic filler.

Street Openings or Cuts.—This is probably the most annoying of all maintenance problems. The practices in general use necessitate securing a permit to make the opening and replacement of the pavement in kind, i. e., the replacement to be made of the same material as the pavement removed. The method of making cuts and restoring them varies widely. Some cities require the company wishing to make the cut to take out a permit for each opening, to pay a fee to the city for the permit, and to make the replacement under city supervision. Other cities permit a company to have a blanket annual authority for making openings where they will, and to pay the city for the number of openings made in a calendar year, the company to replace the pavement. Still other cities permit a utility company to make the cut, charge them a fee for the permit and for the restoration, and then have the restoration made either by city forces or by an annual city contract. The committee believes that this subject should be one of those brought out at an open meeting discussion, and some effort made to secure uniform practice throughout the country.

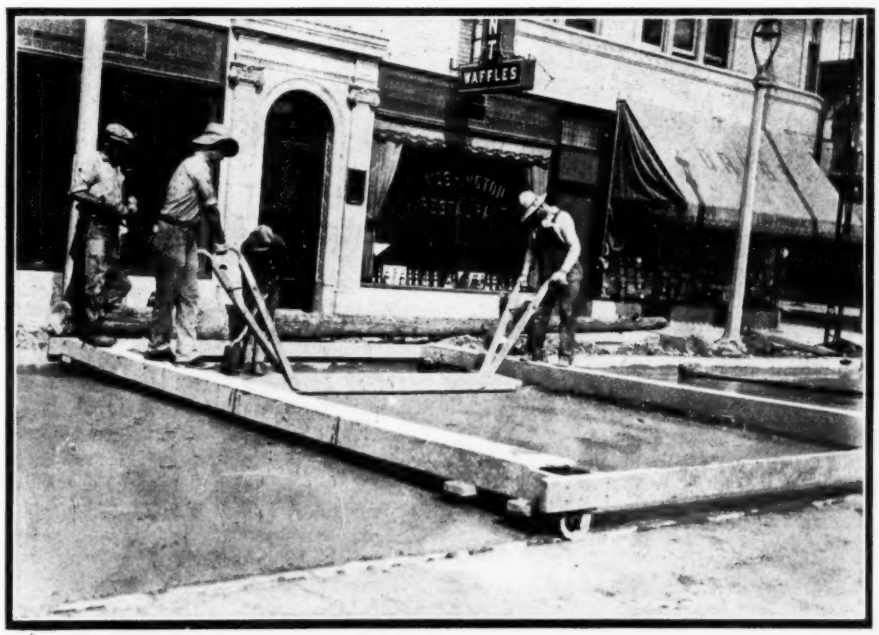
Street Cleaning.—The subject of street cleaning comes, from an organization standpoint, in some cities under the same head as highways; in others it is a separate bureau or department and has no connection with the highway organization. The street cleaning work sometimes consists of the flushing and cleaning of streets, the cleaning of inlets, the removal of garbage and waste, including ashes and sometimes one or more of these functions are done by other bureaus. Snow removal is handled, in some cities, by the street cleaning department, and in some by the highway department; other cities unite both departments and clean snow as an emergency measure.

For the normal cleaning of streets, the larger cities nearly all use power equipment for cleaning and flushing, supplemented in many cases by hand sweeping. Some cities use a vacuum or horse drawn brooms followed up by hand sweeping.

Snow cleaning and snow removal are handled in many ways by different cities. Some use snow blades mounted on trucks and simply plow the snow to the sides or center of the street; other cities use power loaders and remove the snow from certain streets; other cities do certain snow removal by hand. This is a very large subject, and it is hoped that this division will see fit to give it a great deal of study.

Resurfacing and Salvaging Existing Pavements.—This is a most interesting subject and one upon which much future discussion will be profitable. In many cases the resurfacing or salvaging is almost as expensive as complete repaving unless the base condition is completely ignored, and if this is done the salvaging is usually of little value. There are many cases where old block or brick pavements which are worn down can be crowned up to a true cross section, and by the use of surface heaters asphalt or other bituminous mixture may be applied to them. This same surface treating method may be used on portland cement concrete pavements, and many engineers believe that the ultimate end of the existing portland cement concrete roads is to cover them with a bituminous top.

Unpaved Streets.—The question of unpaved streets is one that varies in each locality. In many sections where there is a hard gravel natural soil, very little attention is paid to a street that has been graded and not paved until such time as buildings are erected on the abutting property. There are other cities, however, where street paving may have been omitted in one or two blocks on a street that is a very



important thoroughfare, and because of the assessment system in vogue the property owners on the abutting property, not having developed it, object to the paving charge. The result is that in most large cities there are certain sections of unpaved streets which are subject to an undue amount of traffic and must be kept in fair condition by the maintenance forces. This usually consists of taking care of the drainage as well as possible, and doing such crowning, including road dragging, as is practicable.

In many cases earth roads are given a dust laying oil treatment; in other cities they are sprinkled with water; while in still others, a bituminous application is made and chips are placed and rolled to give an inexpensive surface which is satisfactory for light traffic, at least in warm, dry weather.

In conclusion, it is believed that the eight sub-committees should be appointed and their work laid out for them at an early date, in order that at the next annual meeting a complete report may be made by each of the sub-committees. There seems to be throughout the country a wide difference of opinion as to the best methods to be employed in maintenance work, and it is believed an effort should be made to standardize the maintenance work of the various cities and that next year the maintenance committee should make recommendations along this line.

The work of sub-committee No. 5, Street Openings or Cuts, and of sub-committee No. 7, Resurfacing and Salvaging of Existing Pavements, covers, we think, two of the most important subjects in the highway field today.

Traffic on City Streets

Committee Report Presented Jan. 15 at Cleveland Convention

By M. O. ELDRIDGE

Chairman Committee on Traffic; Assistant Traffic Director, Washington, D. C.

THE City Officials' Division of the American Road Builders' Association, when organized in Washington on June 8, 1928, decided that one of its four major committees should deal with the question of traffic.

The object of the association in creating this committee was to collect and disseminate useful information, regarding traffic problems and to cooperate with other organizations in bringing about a reduction in the appalling loss of life, personal injury and property damage, and to facilitate the movement of traffic on the nation's streets and highways.

The traffic committee has not yet been organized, but a tentative schedule of assignments for committee work has been proposed as follows:

1—Causes of Accidents.
2—Rules of the Road.
3—Traffic Light Signals and Signs.
4—Parking Regulations.
5—Weights and Loads.
6—Traffic Zoning and Classification.
7—Drivers' Permits.
8—Safety Equipment.
9—Street Lighting.
10—Traffic Law Enforcement.

A letter was sent to each member of the city officials' division, who had indicated his willingness to serve on the traffic committee, requesting suggestions based on observations and experience on any one or all of the subjects selected for committee assignment. This was done in order that a preliminary report might be prepared and presented at the annual meeting of the association.

Sub-committee chairmen will be selected as soon as possible and assigned to the task of finding out how cities are going to take care of their future traffic problems and at the same time bring about a reduction in traffic fatalities and accidents.

Uniform Motor Vehicle Laws.—It is believed that the association should at this time approve and support the National Conference on Street and Highway Safety in its effort to bring about the enactment of uniform motor vehicle laws in the various states and uniform municipal ordinances in the various cities.

After two years' work by nearly a thousand representatives from every state in the Union, composed of traffic specialists, engineers and experts, and including official delegates appointed by the governors of forty-three states, a uniform motor vehicle code known as the "Hoover" Code was adopted in 1926.

This code, consisting of four separate acts, has been approved by the National Conference of Commissioners on Uniform State Laws and by the American Bar Association.

These proposed acts are—first, a motor vehicle registration act; second, a motor vehicle anti-theft act; third, an operators' and chauffeurs' license act; and, fourth, an act relating to the rules of the road and the operation of motor vehicles.

Municipal Traffic Ordinance.—Owing to the fact that there is less uniformity in traffic regulations of cities than in state laws the National Conference on Street and Highway Safety was requested to supplement its previous work by the preparation of a municipal traffic ordinance which might be used as a model for cities. Accordingly the Uniform Vehicle Code has been supplemented by a model Municipal Traffic Ordinance which was adopted by the Conference in August, 1928.

The Uniform Vehicle Code includes all the provisions ordinarily contained in the state laws, such as the basic regulations relating to speed limits, reckless driving, rules of the road, safety equipment of vehicles, licensing of drivers, suspension and revocation of operators' permits, registration of vehicles and anti-theft provisions.

The model ordinance sets up a uniform procedure in regard to the direction and control of city traffic, the erection of directional and warning signs, signals and markers, the parking of vehicles, and rules of the road for the protection and regulation of both pedestrian and vehicular traffic peculiar to city streets.

The proposals made in both of these codes are based on the wide experience and good judgment of the best known traffic specialists, engineers and experts in the United States.

This work was recently supplemented by a valuable contribution made by the American Engineering Council for the National Conference on Street and Highway Safety suggesting standard practices, relating to street traffic signs, signals, markings and traffic control devices.

The Traffic Committee will endeavor to place in the hands of those members who are interested in traffic, a copy of the three reports above referred to, and, it is urgently requested that they use their influence to bring the adoption of these model laws and regulations in their respective states and cities. This is particularly important just now at some forty-three legislatures meet early this year.

Need for Traffic Surveys.—No city can expect to make any real progress in reducing accidents or in solving its intricate traffic problems until it is in position to make careful and continuous engineering surveys as to the quantity and quality of its traffic, and until it is able to say to some degree of certainty where, when, how and why accidents occur.

To this end it is recommended that every city in which the traffic problem has become acute, and that means practically every large city, should establish an engineering traffic department or bureau. The municipal traffic ordinance contains in an appendix a suggested form of municipal enactment creating such a traffic engineering department.

Such department should be equipped with adequate funds and trained personnel for making traffic surveys, flow maps and spot maps and for tabulating and analyzing traffic accident reports. Such surveys and studies will indicate among other things:

1—Where traffic lights should be erected.

2—Which streets should be designated as through streets.

3—Where "Stop" signs should be placed.

4—Which streets should be well lighted at night.

5—Which streets should be designated for one-way traffic.

6—Where, in the interest of safety or for increasing street capacity parking should be restricted or eliminated.

7—Those streets which should be

paved, widened or zoned for special classes of traffic.

Improvement in Traffic Conditions at Washington, D. C.—Many of the proposals made by the National Conference of Street and Highway Safety have been adopted in Washington, D. C. Additional features of the code will be adopted as soon as Congress can be induced to so amend the traffic act. The proposals already adopted have resulted in bringing about an improvement in traffic conditions.

This improvement has been brought about by—

1—Electric traffic signal lights along the lines suggested by the American Engineering Council.

2—The establishment of a system of through streets and the prohibition of parking on the flow side of such streets during the rush hour.

3—By the installation of a practical and effective program providing for the licensing of all motor vehicle drivers after an examination on the regulations and a driver's test.

4—By the prompt cancellation or suspension of the drivers' permits of those who have committed serious traffic offenses or who are found to be mentally or physically incapable of safely operating an automobile.

5—By a vigorous and impartial enforcement of the traffic laws and regulations.

That the traffic reforms adopted in the nation's capital are accomplishing the desired results is shown by the fact that fewer persons in each 100,000 of population have lost their lives in traffic accidents in Washington during the past three years than in any other metropolitan city in the United States.

In all fairness it must be said, however, that during the past year the traffic fatality record of one large city, namely, Baltimore, has shown an improvement over that of Washington.

In conclusion let me emphasize the thought previously expressed in this report and that is, that no city can expect to make any material improvement in its traffic accident problem until it is able to say with some degree of certainty where accidents occur, how they occur and why they occur.

City officials should always remember that accidents do not happen—they are caused. It is, therefore, recommended that this thought be adopted as the slogan of this committee—

"ACCIDENTS DO NOT HAPPEN—THEY ARE CAUSED."

Typhoid in the United States.—According to Public Health Reports for Sept. 7, 1928, the number of typhoid fever cases was unusually small during the past summer. The total for the eight weeks from July 1 to Aug. 25 was 5,821 as compared with 7,600 for the corresponding weeks in 1927 and 8,527 in 1926.

Bibliography on Regional Government

A Bibliography on Regional Government has recently been prepared under the auspices of the School of Applied Social Sciences and the Political Science Department of Western Reserve University.

Considerable time has been spent in making the Bibliography as complete and specific as possible. It contains 58 pages and references to about 645 specific sources, together with an outline and index with page references.

Part I includes articles and books of a general nature, while Part II refers to the various forms such as Special Districts, Annexations, City-County Consolidation, Borough Government and Metropolitan Areas. Parts III and IV contain references to County and Township Government. Part V includes articles on the Legal Aspects of this problem. Part VI deals with current bibliography. There are references to English and German articles as well as American.

This Bibliography has been carefully mimeographed and bound ready for distribution. Copies may be purchased at 50 ct. each on application to Roland Mulhauser, Library of Research in the Social Sciences, Western Reserve University.

Westchester County, N. Y., to Spend $1,545,000 for Park Maintenance.—The Westchester County Park Committee White Plains, N. Y., has notified the County Board of Supervisors that its 1929 budget would call for about $1,545,000 to operate and maintain the park system, including the general offices at Bronxville and "Playland," the newly opened amusement park operated by the commission at Rye Beach. This is an increase over the 1928 appropriation of approximately $343,000, but is due to more park facilities.

Indiana Water Works Men Meet in February.—The next meeting of the Indiana Section of the American Water Works Association will be held Feb. 27-28 at Indianapolis, Ind. C. K. Calvert, 1902 North New Jersey St., Indianapolis, Ind., is secretary.

Water Wasted by Various Size Orifices

The 40th annual report (1927) of the Board of Water Commissioners of Dover, N. H., contains the following interesting table showing the amount of water wasted through different sized openings. The table is calculated for a rate of 23 ct. per 100 cu. ft:

Cost of Water Wasted by Various Sized Openings

Diameter of orifice in fraction of an inch	POUNDS PRESSURE PER SQUARE IN. AT ORIFICE 50 lb. Cubic feet discharged per day	50 lb. Value at 23c per 100 cu. ft.	65 lb. Cubic feet discharged per day	65 lb. Value at 23c per 100 cu. ft.	85 lb. Cubic feet discharged per day	85 lb. Value at 23c per 100 cu. ft.
1-16	153	$ .35	167	$ .38	198	$ .45
1-8	613	1.31	667	1.53	760	1.74
1-4	2,467	5.77	2,667	6.13	3,066	7.05
3-4	21,333	49.07	24,400	56.12	28,000	64.40
1	39,466	90.87	42,667	98.12	49,066	112.85
1-2	9,867	22.79	10,667	24.53	12,266	28.21

The Troubles of the City Clerk

The following quip comes to us on the back of the business card of Mr. Arthur W. Smith, City Clerk, Amsterdam, N. Y.:

Pity the City Clerk

If the City Clerk writes a letter, it is too long.
If he sends a postal, it's too short.
If he sends out a notice, he's a spendthrift.
If he doesn't send out a notice, he's lazy.
If he attends a committee meeting, he is butting in.
If he stays away, he is a shirker.
If he sends out bills, he is insulting.
If he fails to collect bills, he is slipping.
If he asks for advice, he is incompetent; if he does not he is bull-headed.
If he writes his reports complete, they are too long, and if he condenses them, they are incomplete.
If he talks on a subject, he is trying to run things, and if he remains quiet, he has lost interest in the city.

Ashes to ashes,
Dust to dust,
If the others won't do it,
The City Clerk must.

Sewer Cleaning at Chicago.—During 1927 the Bureau of Sewers of Chicago cleaned 9,685,000 ft. of sewers by flushing, and 892,200 ft. by scraping. In addition 28,860 catch basins were cleaned by machine and 48,665 basins by hand. The cost of the work, according to the annual report of Geo. E. McGrath, Superintendent of Sewers, was as follows:

Flushing, per 1,000 lin. ft.	$ 7.58
Scraping, per 100 lin. ft.	13.67
Catch basin cleaning by hand	3.93
Catch basin cleaning by machine	2.63

Rocky Mountain Water Works to Meet.—The 3rd annual meeting of the Rocky Mountain Section of the American Water Works Association will be held Feb. 14 and 15 at Denver, Colo. D. E. Kepner, Division of Sanitary Engineering, State Board of Health, Denver, Colo., is secretary.

Eight Million Dollars Voted for Airports.—Bond issues for the purpose of purchase or development of municipal airports were voted at the November election by Detroit, Columbus, St. Paul, Seattle, Hartford, Chattanooga and five other cities aggregating almost $8,000,000. Detroit alone voted a bond issue of $5,000,000.

Annual Convention of Montana Water Works Men.—The 4th annual convention of the Montana Section of the American Water Works Association will be held April 4, 5 and 6 at Great Falls, Mont. H. B. Foote, Division of Water and Sewage, State Board of Health, Helena, Mont., is secretary.

The Water Filtration Plant of the City of Montreal, Quebec

Construction and Operation Features of New Extension

By F. E. FIELD and J. H. HARRINGTON
Filtration Engineer, Montreal Water Board; and Chemist Montreal Filtration Works

THE plant as originally designed by Messrs. Hering and Fuller and constructed under their supervision included the following:

Low lift pumping station, capacity 150 m.g.d. (Imp.).

Sixteen pre-filters, nominal combined capacity, 50 m.g.d. (Imp.), unit sand area, 1,200 sq. ft.

Sixteen final filters, nominal combined capacity, 50 m.g.d. (Imp.), unit sand area, ⅜ acre.

Filtered water basin No. 1, capacity 6¼ m.g. (Imp.); and such conduits, gate houses and equipment to make the installation complete and ready for operation.

Construction work was started in 1911, but on account of numerous delays was not completed and placed in service until April, 1918.

The cost of this plant complete, exclusive of land, was $1,408,300, or $28,000 per m.g.d. (Imp.) at normal rating.

The original scheme was to have the pre-filters and final filters operated together as one plant, i. e., double filtration, without the use of coagulant, but the conduits and gatehouses were designed to permit of the pre-filters and final filters being operated as separate plants or as partially combined plants.

This foresight on the part of the designers of the original plant has been amply justified.

In 1910 the average daily output of the municipal water works plant was 38 m.g. and the filter plant was designed for 50 m.g.d. nominal capacity which would permit of a 30 per cent increased output.

In 1918, the first year of operation, the required output of filtered water was 60 m.g.d. (Imp.) or 20 per cent above the designed nominal capacity of the plant.

The demands for filtered water increased rapidly in succeeding years and last year, i. e., 1927, the daily output was 85 m.g. (Imp.) or 70 per cent in excess of the designed nominal capacity of the plant.

During July, 1928, the average daily output was 92 m.g. and the maximum day's output was 97.6 m.g. or 94 per cent in excess of the designed nominal capacity of the plant.

Notwithstanding this excessive overload on the filters, the plant has run continuously and has at all times delivered to the citizens of Montreal a water satisfactory in all respects.

Filter Extension.—The need for additional filters has been recognized for several years, but construction was delayed until adequate pumping capacity was provided by the completion of the new low level pumping station.

This contains six 30 m.g.d. pumping units with provision for extending the building to house six additional pumps of the same capacity.

To provide ample storage of filtered water, filtered water basin No. 2 was constructed between filtered water basin No. 1 and the new low level pumping station. This basin, having a capacity of 20 m.g. (Imp.), was constructed at a cost of $624,400.

During the construction of the new low level pumping station and filtered water basin No. 2, several schemes for filter extension were studied and estimates of cost compared. The satisfactory operation of the existing pre-filters and the comparatively low cost of constructing 32 additional filters, similar in size, arrangement and general design, above the roof of filtered water basin No. 1 resulted in this plan being adopted.

These 32 additional filters will have a combined nominal capacity of 100 m.g.d. (Imp.) which added to the original plant will make the total nominal capacity of the plant 150 m.g.d. (Imp.), which equals the nominal capacity of the new low level pumping station.

In all probability the original 16 pre-filters and 16 final filters will be operated as a combined plant and the 32 new filters will be operated as rapid sand filters and discharge independently into filtered water basin No. 2.

The cost of this work now nearing completion may be subdivided as follows:

Earthwork, filters, buildings, etc.	$ 360,000
C. I. piping, gate valves and sluice gates	213,958
Air piping and small piping	17,880
Filter rate controllers	40,000
Filter operating tables and gages	66,641
Filter strainer and air system	67,867
Wash water gutters	17,203
Filter sand and gravel	69,038
Gages, telephone system and signal system	12,129
Chlorination building and equipment	24,000
Park lighting system	14,303
Fence and gateways	46,000
Greenhouse, trees and shrubs	11,500
Miscellaneous work and equipment	48,621
Total	$1,009,140

This makes the cost of the filter extension $10,000 per m.g.d. (Imp.) nominal designed output.

The total cost of the filtration works is therefore $2,417,440, which on the nominal designed capacity, 150 m.g.d. (Imp.), makes the construction cost $16,116 per m.g.d.

Filter Strainer and Air System.—The strainer system in the original pre-filters and the new rapid sand filters are identical and furnished by the Roberts Filter Mfg. Co. It consists of C. I. manifolds and 1¾-in. C. I. pipe laterals on 6-in. center, approximately 6 ft. in length with two $\frac{3}{16}$ bronze orifices for each 6 in. of lateral.

This system is for both air and water wash. The air is supplied from a rotary Root's blower having a capacity of 5,000 cu. ft. of free air per minute against a pressure of 5 lb. per square inch, which gives approximately 4 cu. ft. of air per minute for each square foot of sand surface in a filter.

The wash water is supplied from a wash water tank and is delivered at the rate of approximately 8½ Imp. gallons per minute for each square foot of sand surface.

Filter Sand and Gravel.—The filter gravel in the original pre-filters and in the new filters is deposited in four layers of specified screened sizes to a total combined depth of 15 in.

The filter sand is 30 in. in depth. In the original pre-filters this sand had an effective size of between 0.50 m.m. and 0.60 m.m. and a uniformity coefficient of about 1.65.

In the new filters the effective size of the sand varies from 0.40 m.m. and 0.50 m.m. and the uniformity coefficient is about 1.68.

In the original final filters, there is 12 in. of graded gravel placed in four layers and 27 in. of sand having an effective size of from 0.25 m.m. to 0.35 m.m.

Rate Controllers.—Each of the original pre-filters and final filters was equipped with controllers of the Earl type with a master controller to regulate the entire system. These controllers have given satisfaction in all respects.

The new filters will be equipped with controllers furnished by the Builders' Iron Foundry and will work in conjunction with their new pendulum diaphragm units for loss of head and rate of flow below and their new loss of head and rate of flow gauges on the operating tables in the filter galleries.

These controllers are also provided with master control.

Average Runs, Final Filters, 1927

Month	No. of Washes	Average Runs Days	Hours
January	22	22	8
February	15	29	12
March	30	16	4
April	42	11	4
May	46	10	9
June	41	11	12
July	36	13	12
August	38	12	18
September	23	20	15
October	24	20	8
November	23	20	13
December	36	13	7
Total	376	....	....
Average	31	16	22

Operating Tables. — All operating tables in the galleries are of the piano type and constructed of gray marble, which makes an attractive contrast with the red tile floor of the gallery.

Clock and Signal System.—The wash water pumps, wash water tank and piping system do not have sufficient capacity to permit of more than one filter to be washed at the same time.

This makes it necessary for the filter operator in one gallery to be kept informed, not only as to the supply of the water available in the wash water tank, but also as to whether or not filter washing is in progress in either of the other two galleries.

It is expected that the clock and signal system will systematize the filter washing and prevent interference in the work of filter operators in the three filter galleries.

This system includes the master clock and signal lights in the superintendent's office, and secondary clocks and signal lights in each of the three galleries, the entire system being electrically operated.

The system is so arranged that when the influent valve to any filter is closed by operating a handle on the operating table, a light will automatically show at the master and secondary clocks and continue to show until the influent valve is again opened; thus completing the cycle of a filter wash.

There is also a switch on each operating table whereby the automatic lighting of the signal from that particular table is cut out, if, for any reason, the influent valve is operated for any purpose except the washing of the filter.

The lights to indicate when filters are being washed are three in number and show red for filters in gallery No. 1, yellow for filters in gallery No. 2, and green for filters in gallery No. 3.

The master clock in the superintendent's office is of the wall type with the three signal lights incorporated in the bottom of the case.

The secondary clocks, suspended from the ceiling in the center of each operating gallery, are double-faced with illuminated dials so as to be easily read from the far ends of the gallery.

The three signal lights are incorporated in the bottom of the bronze case.

The depth of water in the wash water tank is also indicated on the clock in the following manner:

Immediately concentric with the outside of the dial is a ring which is automatically illuminated to show the depth of water in the tank. The total depth of the wash water tank is 12 ft., which corresponds to the hour figures on the clock dial. Therefore, by reading clockwise, the hour figure at the end of the band of illumination will indicate the depth of the water in the tank.

Inter-Phone System.—To still further assist the operators in the performance of their work, an inter-communicating telephone system will be installed.

Telephone sets will be installed in the superintendent's office, clerk's office, in each of the three filter operator's booths, at the electrical operator's desk in the pumping station, in the chlorination building and at such other places as are deemed necessary.

In galleries Nos. 2 and 3 the discharge from each filter enters a gallery effluent conduit which extends the entire length of the pipe gallery and passes through a gatehouse into a conduit which discharges into the filtered water basin.

The water level in the filtered water basin is several feet lower than the invert of this gallery effluent conduit. With water in the filtered water basin at a low level and with a low rate of discharge in the gallery effluent conduit, the discharge ends of the filter effluent pipes would not be submerged, thus allowing entrance of air to the bottom of the filter beds when the water level in the filtered water basin raised or the discharge through the gallery effluent conduit was increased.

To prevent any possibility of air entering the filters in this manner, a water level controller will be installed in the gatehouse at the end of each pipe gallery.

A float operating a pilot valve connected to the piping of the hydraulic cylinder of a 60-in. by 60-in. sluice gate, controlling the discharge of the gallery effluent conduit, will automatically maintain the water level in the gallery effluent conduit in such manner as to keep the filter effluent pipes submerged, and not decrease the available loss of head in the filters.

Chlorination Building and Equipment. —This building is above the chamber through which all filtered water passes on its way to filtered water basin No. 2 and the new low level pumping station.

This chamber is provided with baffle walls to obtain a thorough mixing of the chlorine dose with the filtered water.

The central portion of the floor of the chlorination building is depressed to permit of the installation of weighing scales with platforms level with the operating floor.

The platforms of these weighing scales are of such size as to allow 12 cylinders of liquid chlorine to be placed thereon.

Each cylinder is connected by piping to a manifold which leads to the chlorination control table. This table is of grey marble, of piano type, similar in design to the filter operating tables.

This table houses "Duriron" ejectors and distributors. The suction produced by water under pressure passing through these ejectors draws the chlorine from the cylinders on the platform scales and discharges it into the baffled current of filtered water in the chamber below.

On the top of the operating table are located the necessary gauges and valve controls and also apparatus for testing the water after chlorination.

The building is of sufficient size to permit of the entrance of a truck loaded with cylinders or drums of liquid chlorine, and an overhead travelling crane facilitates the handling of these liquid chlorine containers.

Park Features.—The filtration works and low level pumping station are located on an 80-acre tract of ground between the water supply aqueduct and the city of Verdun. An attractive iron fence, 5,000 ft. in length, marks the boundary line on three sides of the property. There are eight gate entrances to afford easy access to all parts of the works.

The north end of the property has already been made into an attractive park by the construction of driveways and paths, grading and seeding and the planting of trees and shrubs.

Two lagoons, each 50 ft. by 150 ft., with water sprays and several flower beds, greatly improve the appearance of the new low level pumping station.

This year we are grading, seeding and planting about eight more acres; and at this rate of progress it will only require a few years to develop the whole

Maximum and Minimum Yields, Final Filters, 1927

Month	Maximum M.G.D.	Minimum M.G.D.	Average M.G.D.
January	82.32	62.47	70.87
February	87.45	75.75	81.70
March	84.39	76.94	80.82
April	81.20	23.19	66.48
May	61.74	22.50	40.73
June	71.06	58.72	65.25
July	71.77	56.87	65.09
August	74.74	63.71	71.41
September	76.17	67.59	72.96
October	74.91	62.03	69.36
November	78.59	62.41	66.58
December	77.66	64.41	70.90
Average	76.83	58.05	68.51
Filter Rate m.g.a.d.	4.80 12.81	3.63 9.68	4.28 11.42

Average Runs, Pre-Filters, 1927

Month	No. of Washes	Average Runs Days
January	83	143
February	77	139
March	149	80
April	847	13
May	421	28
June	239	32
July	283	42
August	197	60
September	89	129
October	90	132
November	134	86
December	140	80
Total	2,758	964
Average	230	80

property. Largely due to the interest shown by the filtration staff during the last few years in the growing of plants and flowers, a small greenhouse, 18 ft. by 37 ft., is now under contract. It is so located that access is available from a covered passage from filter gallery No. 1 and will permit the growing of plants for the outside flower beds and for decorating the filter buildings and pumping station.

Raw Water Supply.—The two river intakes from which the filtration works obtains its supply of raw water are located about 20 miles below the confluents of the St. Lawrence and Ottawa Rivers. The intake normally in use is about 1,200 ft. from shore; the other or shore intake is protected by ice cover in winter and can be used when frazil ice causes trouble in obtaining the required volume from the outer intake.

Both intakes supply varying mixtures of the St. Lawrence and Ottawa River waters, depending upon seasonable and local weather conditions.

The shore water is largely Ottawa River water and carries all the domestic pollution of 12 small towns, except that which is diverted into the Lachine Canal.

From these intakes, the raw water is conveyed by the Montreal aqueduct canal and its lateral conduit, a distance of about five miles to the filtration works. The lower three miles of the Montreal aqueduct now serves as a sedimentation basin with about 30 hours storage at a 100 m.g.d. rate of flow which quite materially reduces the number of bacteria of sewage origin in the raw water before it reaches the filtration works.

As regards physical characteristics, the outside water is more desirable than than from the shore. Turbidity is not a serious problem, as neither river carries much suspended matter except for short periods in the spring and sometimes in the fall.

The normal color of the St. Lawrence River (outside water) is from 10 to 15 p.p.m., while the color in the shore water may reach a maximum of 8 p.p.m.

The operator therefore endeavors to have the intakes controlled in such manner as to reduce as far as possible the entrance of shore water.

Rapid and Slow Sand Filters, 1927.

Maximum and Minimum Yields, Pre-Filters, 1927

Month	Maximum M.G.D.	Minimum M.G.D.	Average M.G.D.
January	56.88	53.78	55.85
February	56.00	55.69	55.84
March	56.00	55.24	56.79
April	55.64	51.19	55.23
May	55.78	51.03	55.43
June	55.80	54.10	55.58
July	56.00	51.28	55.47
August	55.83	54.80	55.64
September	56.00	54.17	55.76
October	55.85	54.31	55.75
November	55.85	55.69	55.81
December	56.00	53.08	55.70
Average	55.90	53.86	55.65
Filter	3.49	3.37	3.48
Rate m.g.a.d.	139.75	134.65	139.13

Cost of Operation

Distribution	Operation Wages	Operation Supplies	Maintenance and Repairs Wages	Maintenance and Repairs Supplies	Total	Cost M.G.	Per Cent
Supervision	$ 3,213.00	$.....	$ 567.00	$.....	$ 3,700.00	$0.12	5.86
Pumping station	10,866.60	313.57	361.41	297.03	11,838.61	.38	18.36
Pre-filters	4,575.39	272.06	698.77	63.47	5,609.69	.18	8.70
Final filters	3,474.35	366.50	1,238.76	1,540.26	6,619.87	.21	10.27
Laboratory	3,085.68	1,489.90	255.98	41.50	4,873.00	.16	7.56
Sterilization	2,417.12	12,534.75	462.45	245.03	15,659.35	.50	24.29
Electric current	.....	14,240.00	.....	.....	14,240.00	.46	22.08
Building and ground	.....	.....	1,737.91	120.58	1,858.49	.06	2.88
Total	$27,632.14	$29,216.78	$5,322.22	$2,307.87	$64,479.01	$2.07	100.00

Total filtrate in 1927, 31,125.12 m.g.

—The rapid sand filters show an average bacterial removal of 73 per cent when operated at an average rate of 139 m.g.a.d. without use of coagulant.

The final filters, with a mixture of raw and pre-filtered water in the approximate ratio of 3 to 4 as applied water, show an average bacterial removal of 85 per cent when operated at an average rate of 11.5 m.g.a.d.

The overall bacterial removal by filtration (i. e., before chlorination) was 87.5 per cent.

Chlorination.—The slow sand filter effluent and that part of the rapid sand filter effluent diverted to the filtered water basin to make up the total daily demand on the plant have been chlorinated during the past year at their mixing point in gate house No. 2.

A small sample pump returns chlorinated water from a point in the filtered water basin representing an absorption period of about two minutes. Hourly samples at this point show the residual chlorine content under these conditions to be very uniform.

Occasionally sixteen tests are made in rapid succession. These tests are always within .03 to .05 p.p.m. variation from the standard required and show that the mixture of chlorine is instantaneous and uniform, a condition essential to otbain high efficiency.

The dose is varied to obtain 0.2 to 0.3 p.p.m. residual chlorine after two minutes absorption.

The percentage of Ottawa River water at the intake varies seasonally and may vary daily through the agency of high winds.

The dose increased or decreased as the percentage of Ottawa River water is greater or less, "Straight" Ottawa River water requires seven times as much chlorine as that from the St. Lawrence to insure practical sterility.

The overall removal of bacteria after chlorination for the past year was 99.9 per cent.

Operation Records.—The following tables show the details of operation during the year 1927:

General Characteristics of Water from Plant, Year 1927

Alkalinity Ca Cos	82	60	71
Turbidity, less than	2	2	2
Color	30	7	22
Incrusting solids	12.6	9.3	11.0
Total solids	129.	109.	118.
Bacteria per c.c.	12.	3.	6.
B. coli per 10 c.c., less than	1.	1.	1.

Acknowledgment.—The above is an abstract of a paper presented at the Montreal Convention of the New England Water Works Association.

Philadelphia Engineers Club to Discuss Concrete

A meeting when the subject of concrete construction—roads and structures—will be under discussion will be held at the Engineers Club of Philadelphia, 1317 Spruce St., Philadelphia, on Feb. 19, 1929. There will be two sessions, with dinner intervening. The first session will be from 2:00 to 5:00 p. m. Dinner at 6:00 o'clock. The evening session, 7:30 to 10:30 p. m.

Papers and discussion will specialize on "High Strength, High Early Strength, and Waterproof Concrete, both from a Theoretical and Practical Standpoint in Design and Construction," will be given.

A number of engineers who are prominently identified with this type of construction will read papers and take part in the discussion. Men from New York, Philadelphia, Washington, Chicago and other cities will be present.

Engineers and contractors who are interested in this subject are invited to attend.

The committee in charge is W. H. Connell, Henry Delaplaine, F. O. Dufour, W. E. McComas, P. M. Taylor, T. P. Watson.

Improvements During Ten Years Operation

	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Unfiltered but chlorinated raw water added to filtered effluent to make up total city demand, m.g.d.										
Raw water added to final filter influent to allow of increased output from final filters, m.g.d.	20.3	13.5	21.8	19.5	19.8	10.6	13.4	7.7	0.8	0.0
Total filtered, m.g.d.	0.0	0.0	0.0	0.0	0.0	4.8	3.2	11.3	19.6	29.6
Total consumption, m.g.d.	42.7	50.8	51.2	50.0	56.2	59.8	58.2	66.3	75.6	85.3
Total cost purification including chlorination	63.0	64.3	73.0	69.5	65.0	70.4	71.6	73.8	76.4	85.3
(Imp.) m.g.d.	.....	.....	4.70	4.71	4.62	3.52	3.78	3.23	2.96	2.07
(U.S.) m.g.d.	.....	.....	3.76	3.77	3.70	2.82	3.00	2.58	2.37	1.66

A Few Details of Sewage Treatment in Germany and England

Some Comments Based on Recent Personal Observation

By SAMUEL A. GREELEY

Of Pearse, Greeley & Hansen, Hydraulic and Sanitary Engineers, Chicago, Ill.

IN England and Germany, much as in the United States, there is an increasing public demand for cleaner streams and for the return of fish life where this has been driven out. This has resulted in Englnad in the recent creation by Parliament of the River's Pollution Research Board with a notable personnel; and in both countries in an increasing activity in sewage treatment work. Munich is building a very large installation of fish ponds for the final purification of a settling tank effluent (cost 5 million marks or $1,250,000); Stuttgart is enlarging its sprinkling filters; Sheffield is doubling the size of its aeration plant; at Birmingham a project has been approved for bringing the capacity of the pre-aeration works up to 24 U. S. M. G. D. and of the sludge gas engine installation from 150 to 600 H. P.; much new construction may be seen in the Ruhr valley, etc. Some of the more pertinent details are briefly described below—based on recent personal observation.

The sewage of most European cities is, of course, low in quantity and high in concentration as compared with sewage in the United States. But, in addition to this proportionate concentration, the strength of the sewage is increased in many instances by the industrial wastes, which have a marked effect because of the relatively small volume of human sewage. Thus at Bury, the sewage is at times acid and at many cities the characteristics of the sewage change sharply from hour to hour.

Preliminary Treatment.—A special point of interest are the oil removal tanks in the Ruhr valley. It is Imhoff's view that perhaps half the oily matters are attached to particles of suspended matter and are not removed by quiescent flotation. Therefore the sewage is agitated or scrubbed with air to break the oil loose from the suspended matter. Quiescent side-pockets trap the oily matters. The quantity of air is indicated at one-tenth the volume of sewage 0.0133 cu. ft. per gallon and the aeration period at three to five minutes.

In many of the English plants, settling periods of eight hours or more are used. Thus the new settling tanks at Reading, to work ahead of aeration tanks, will have a displacement period of about ten hours. These relatively large settling tanks serve as balancing tanks tending to make both the rate of flow and character of sewage more uniform. Further, experience seems to indicate a coagulating process in the settling tanks which tends to wash out some colloidal matter and so better prepares the sewage for further treatment.

In the Ruhr valley, separate sludge digestion tanks are being used in conjunction with deep 2-story tanks having relatively small sludge compartments. It is held that the sludge is concentrated in the 2-story tank, thus requiring much less volume in the separate tank; and that the temperature and reaction of digestion can be better controlled in the separate tank. The combination of the two is thus favorable as to both economy and efficiency.

Sludge Digestion.—The digestion of sludge in separate tanks appears to be gaining in favor somewhat slowly, but along sound lines. The oldest separate digestion works visited were at Birmingham, first started in 1909; the most recent were in the Ruhr valley. Most of the digestion tanks were characterized by having relatively flat bottoms as compared with practice in the United States. Bottom slopes as flat as 1 in 100 were used. The sludge is withdrawn by gravity or by pumping, but sludge pumps are generally provided for circulating sludge and for mixing ripe and fresh sludge. In fact, a sludge pump appeared to be required for good operation and the intimate mixture of ripe and fresh sludge was often regarded as an essential routine procedure and was accomplished by passing them together through the pump. The proportions of the two sludges in the mixture varied of course, even at the same plant, but approximated one part of ripe sludge to from 3 to 5 parts of fresh sludge.

It seems to be accepted that the best way to heat the sludge is by pumping hot water into it. This was done in the Ruhr valley, at Stuttgart, and occasionally, in very cold weather at Birmingham. The temperature of the hot water supply at Stuttgart was 150° F. and at Essen Relinghousen upward of 185° F. The water was heated by burning the sludge gases and was relatively small in quantity, the indication being that the radiation losses were not considerable.

A variety of covers were in use. The floating sectional concrete covers at Birmingham made a very favorable impression. As Essen Relinghousen the digestion tank has a fixed concrete cover with a circular opening about the circumference which laps over a triangular corbel built out of the side wall, much like the traps in a 2-story tank. The fixed concrete cover was submerged about 2 ft. with scum, but there was little or no escape of gas. At Stuttgart a flat arched slab was used. However, there appeared to be little fear of odors from open digestion tanks which were being adopted for some new installations.

Sludges from primary settling tanks, final settling tanks and excess activated sludge were all returned to the digestion tank, but the weight of practice favored the delivery of the final and wetter sludges to the incoming sewage, to be settled out and recovered with the primary tank sludge and then discharged into the digestion tank. Their moisture content was thus reduced and Imhoff suggests a capacity of 2 cu. ft. per capita for digesting both primary and final sludge, one-third being in the 2-story tanks.

Sludge Gas.—Gas from the digesting sludge is being caught, measured, and used. In some cases the gas is used only for heating the water which is pumped into the sludge tank as at Stuttgart and Essen Relinghouse. But at Iserlohn in the Ruhr valley all the power required for the operation of the sewage plant is made by the operation of a small gas engine working directly on sludge gas. At Birmingham a 150 H. P. gas engine has been working directly on sludge gas for the last nine months and an additional 450 H. P. unit is about to be installed. The gas is not cleaned in any way and there is no gas holder, the only storage being in the gas catchers floating on the sludge. It was stated that there had been no evidence of pitting during nine months of almost continuous service. It is estimated that the sewage of Birmingham (close to one million people) will yield enough sludge gas to produce 1,000 brake horse power.

Extensive detailed information relating gas quantities to weights of organic matter, temperatures of digestion, and the like cannot be acquired in a short visit. The following round figures, however, were given for sludge from primary settling tanks:

Place	Gas in Cubic feet per capita
Ruhr Valley	0.37—0.28
Stuttgart	0.32
Munich	0.47
Birmingham	0.41

In the new (1928) edition of his hand book, Imhoff gives an excellent typical computation of gas quantity based on organic matter under digestion and the conditions of digestion. Thus (page 67) on the basis of 15 grams per capita per 24 hours of organic matter in the settling solids, the actual quantity of gas is 0.37 cu. ft. (10.5 litre) per capita per 24 hours, of which Imhoff estimates 0.28 cu. ft. may be developed in routine operation.

Biological Treatment.—Aeration by mechanical agitation has been in operation in England for three to four years and its use is continuing. The paddle wheels at Sheffield have been treating 9.6 to 12. U. S. M. G. D. of settled effluent for nearly four years with, apparently, marked success and the installation is now being doubled in size. The plant makes a most favorable impression. Simplex aerators have been in operation at Bury for over three years and are being installed in several other places. Plants using air are also being built and there seems to be no preponderance of opinion. Perhaps, on the whole, more aeration plants are being built at the present time with mechanical agitation than with air and in the Ruhr valley a combination of air and paddles is successfully used in the same tank.

Sprinkling filters are still in use for two-thirds of the sewage at Bury and new units have been added at Birmingham within the last year. There seems to be no disposition to discard them in favor of the activated sludge method and many can be seen in operation in England. In a general way, comparative total annual costs of sprinkling filter and activated sludge plants were not far different from the trend of such costs in the United States, the total annual costs being about equal when power costs around 1 ct. per kwh.

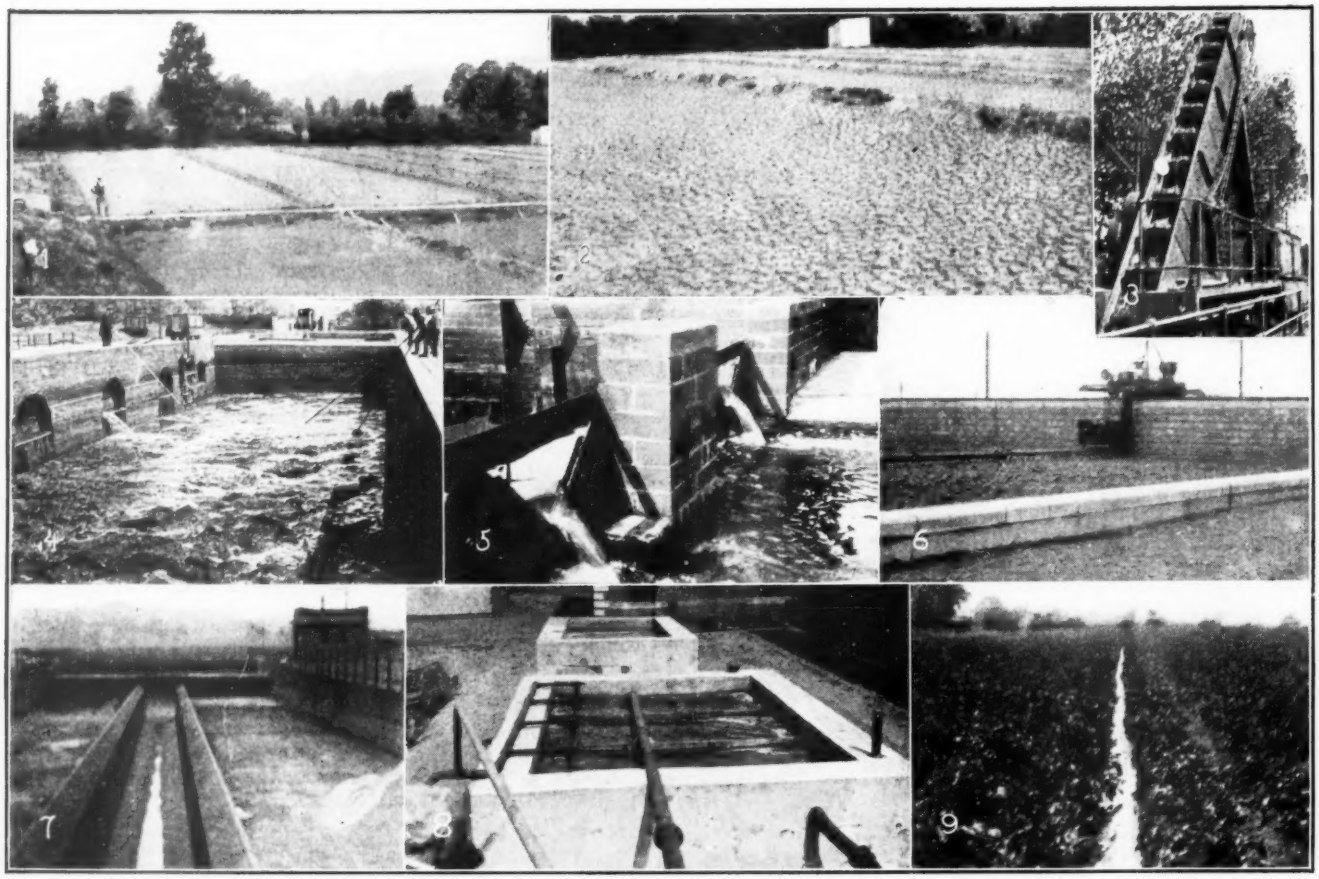
The partial aeration of the sewage between the settling tanks and sprinkling filters at Minworth has been successful and the capacity is being extended from 9.0 to 24.0 U. S. million gallons per 24 hours. The sewage is agitated in contact with activated sludge by air and paddles for one hour in channels having a cross-section of 18 sq. ft. and a flow length of 3,300 ft., and then settled in upward flow settling tanks. The sludge is reaerated with air for 10 hours at the rate of somewhat over 1.5 cu. ft. per gallon of sludge. This pre-aeration has permitted an increase of the quantity of sewage applied to the filters of about three times.

There is no indication of projects to process activated sludge to a fertilizer base in England or in Germany.

I was told in England that the cost of a complete treatment plant was not far from 2 pounds ($10) per capita of rated capacity.

The new filters at Minworth (Birmingham) have been equipped with travelling disturbutors on rectangular beds. I gathered that operating experience with travelling and fixed spray distributors indicated that a somewhat greater load could be handled by the filters with the travelling distribution. It is interesting to see sprinkling filters at Birmingham which have been in continuous operation for 25 years without any marked deterioration of the filtering material. Broken granite, coke breeze and broken gravel are used. Some of the filters have a top layer of fine gravel (about ¼-inch size), some 12 in. thick.

Final Sedimentation.—I found more common use of deep upward flow tanks for final sedimentation than of any other sewage treatment device. Such tanks are generally built square or round, perhaps 30 ft. in diameter and 25 to 30 ft. deep. The aeration tank or filter effluent is discharged at the bottom of a relatively large vertical



Sludge Drying Beds and Miscellaneous Views of Various Features of English Sewage Disposal Works

(1) Sludge-Drying Beds at Bath Sewage Disposal Works. (2) Air-Dried Sludge Ready for Removal from Bed at Bath Sewage Disposal Works. (3) Mechanical Removal of Coarse Detritus at Birmingham Sewage Disposal Works. (4) Cleaning Detritus Tank at Birmingham Sewage Disposal Works. (5) Effluent Weirs at Manchester Activated Sludge Treatment Plant. (6) Traveling Distributor at Leeds Sewage Disposal Works. (7) Storm Water Overflow at Leeds Sewage Disposal Works. (8) Experimental Activated Sludge Sewage Treatment Unit at Kidderminster. (9) Kidderminster Sewage Form, Showing Irrigation of Sugar Beet Crop.

flume and generally not over 10 to 12 ft. below the surface. Weirs, built very accurately, are provided on all sides for taking off the clear liquor. The settling periods in these tanks were not generally over two hours, but the upward velocity computed on a displacement basis was the more usual index of size, the following figures being typical:

Character of sewage	Limiting Upward Velocity in ft. per hour
Crude or screened sewage	14.0
Filter effluent	10.5
Aeration tank effluent	4.5

With aeration tank effluent, the sludge was withdrawn continuously, the rate being controlled by a valve on the outlet pipe and the quantity measured by a weir between the outlet pipe and the sludge return pumps. At Essen Relinghousen, the sludge was passed through a fine screen (1 mm. mesh) before it was returned to the aeration tanks. The material retained by the screen and washed off with a stream of sewage was coarse and fibrous and was considered to contain little active sludge. It was pumped to the sludge digestion tank with the excess.

General.—The visitor is especially struck by the generally fine appearance of the Europeon sewage works. Most of them have attractive buildings and considerable planting including shrubs, vines, and flowers. Except where there was little or no attempt to digest sludge, odors were not in evidence, partly because of the fresh sewage and partly because of the clean condition of the plants.

There is a considerable range in the methods of treatment and the loadings as illustrated by the long displacement period in the English settling tank as compared with the short ones in the Ruhr valley works. The relatively low per capita quantities of sewage, brings more ample capacities within financial reach and the plants as a whole appeared to be less heavily loaded than many in the United States. Thus the strong sewages at Decatur and Ft. Worth, which approximate the strength of the Birmingham sewage, have nearly four times and twice the per capita rate of flow respectively.

Note should be made of the care given to the distribution of the sewage to the various units by vertical swing gates, weirs, and orifices. At Birmingham the inlet pipe to each settling tank is flanged and a vertical plate orifice inserted between the flanges with a valve on the inlet side. A U tube indicates the loss of head through the orifices and this loss is kept the same at each inlet throughout the battery of tanks.

Other points of interest related to the conveyor machines for removing sludge from drying beds at Stuttgart and Munich; and the general use of some form of storm water treatment.

The Beccari Plant at Scarsdale, N. Y.

Fermentation Process of Disposing of Organic Waste

By ARTHUR BONIFACE
Village Engineer, Scarsdale, N. Y.

IN THE choice of a method for garbage disposal, local conditions must of necessity govern the type selected and the fact that these conditions are different in almost every locality calls for the guidance of competent technical talent to solve the problem.

Why the Type Was Selected.—Perhaps the most difficult situation to meet is the one presented by the high class built up community with a population of about 10,000. Lacking an appropriate district to choose as the site for a disposal plant, the unmost caution must be exercised for fear of the effect its establishment would have on adjacent property.

It is under the latter category that Scarsdale takes its place and explains why the choice of plant fell to the one selected. Scarsdale is located about six miles north of the northern limits of New York City. It is known as one of the highest type residential communities in the east, has a population of about 9,500, embraces territory over six square miles, and has an assessed valuation of $50,000,000. Prior to 1923 its household wastes were removed by 15 private collectors, with the usual indifferent service that accompanies a method lacking governmental control. Therefore, during the summer of that year the municipality took over the collection and disposal of waste, and after extended study chose for the disposal of its organic waste, a plant patterned after the fermentation type much used in Italy. Its choice, primarily, was due to the fact that the building lent itself to architectural treatment, was simple to operate and further, that a humus could be produced bearing high value as a fertilizer.

To those not familiar with this method of disposal it may be stated that the Fermentation System established in Italy in 1914 first contemplated the reclamation of organic waste accumulated on farms, with a view not only to its salvage, but to an increase in its effectiveness as a fertilizer. Later the system was successfully applied to the disposal of organic waste produced by municipalities.

The plant erected in Scarsdale was an eight cell unit constructed of concrete, the design being practically identical with the units in use in Florence, Italy.

No reference will be made to the details of design, followed in the original structure built in Scarsdale, for reasons that will be obvious later.

Early Operating Results.—The plant commenced operation in December, 1923, following closely the methods employed in the Italian cities, viz., cells were charged to capacity with organic matter, hatches and side doors closed, and the contents left undisturbed for periods varying from 45 to 60 days, at the expiration of which the residue was removed and stored in the side sheds built as a part of the plant.

The humus produced in the early operations contained about 45 per cent moisture and on removal from the fermentation chambers emitted decidedly objectionable odors; moreover, it bore no resemblance whatever to the humus produced in the Italian plants, and although subsequently it was dried and ground and the work and nuisance involved in so doing made it undesirable to continue.

Numerous studies, investigations and experiments followed, all of which form an interesting chapter in the development of this means of disposal. It should be stated, however, that the early operation of the plant fell short of expectations, first—because, filling a chamber 9 ft. high with wet garbage resulted in producing a mass impervious to air, which was fatal to success, and second—the various components of our raw garbage seemed to produce an acid condition detrimental to the development of the biological processes.

The design and operation of a fermentation plant do not call for any complicated technique, only the observance of two fundamental principles, which are, neutralization of the mass and sufficient means of aeration in the cell after the mass has passed its initial stage of decomposition.

Details of Reconstructed Plant.—As reconstructed, the plant in Scarsdale consists of an eight cell unit, each chamber having a capacity of 20 cu. yds. The floor of the cell is graded so as to drain the liquid to the sump or sewer below. The interior is divided into five layers by means of gratings, spaced 18 in. center to center. These are constructed of 2 x 3 creosoted pine for ease in handling. Two small port holes for the admission of air are located just above the floor, and in the roof a six inch hole is provided for the passage of the gases generated in the mass below. There is a hatch on top for charging and a sliding door on the side for discharging. Connected to the outlet in the roof is an air washing chamber two feet in diameter and 10 ft. long in which a series of sprays are located; these are operated by a one inch centrifugal pump, and a one-third H. P. motor connected to a 50 gal. tank, charged with a 1:500 solution of potassium permanganate. The object of this washer is to remove any possibility of nuisance due to the emanation of gases from the mass during its early anerobic stages.

Practice at Scarsdale.—The practice followed in Scarsdale is to bring the raw garbage to the floor formed by the

roofs of the cells; here it is dumped and spread, and commercial hydrated lime in proportion of about 1½ per cent by weight is added to effect neutralization. To stimulate anerobic action a small quantity of ammonium sulphate in the form of a 10 per cent solution is poured over the mass. The garbage is then shoveled into the cell, and the process described repeated until each chamber is filled.

Immediately after closing the cell, a vigorous nitrifying action is noted, and the temperature gradually rises, until about the third day it has reached around 150 to 155° F., which it holds for three or four days, then slowly drops, according to the season of the year, to 110 degrees at the 30th day, when the residue may be removed, ground and bagged.

The quantity of humus obtained from one cell is 12 to 16 per cent by weight of the original charge, and when analyzed averages:

Nitrogen	2.59 to 3.00 per cent
Potash	0.60 to 1.76 per cent
Phosphoric Acid	2.64 to 3.50 per cent
Moisture	10.00 to 12.00 per cent

The humus is sold wholesale at $25.00 per ton, which yields a net revenue of approximately $22.00 per ton after deducting cost of treatment.

The procedure just described might give the impression of being involved, but all operations are conducted by common labor only.

Briefly summarizing, the process divides itself into two interrelated treatments. In the first stage, the garbage is enclosed in a cell against the access of air, thus stimulating the action of the anaerobic bacteria which cause the mass to break down and liquefy the readily decomposable elements. Passing into the second stage, the mass is subjected to a current of air at atmospheric pressure initiating the action of aerobic bacteria. The flow of air admitted through the small portholes and thence through the mass not only stimulates aerobic action, but tends to dry the contents of the cell, and finally a good grade of fertilizer is obtained, free from noxious odors.

Cost.—As to the cost of such plants, figures will differ according to locality, but roughly estimated, the cost is $2,000 per 1,000 population, or $20,000 for a village or city of 10,000. It would be well, however, to have several cells in reserve in case of emergency, which would add to the unit cost proportionately.

In designing the individual cells, a size should be chosen that would provide for its being filled within 48 hours, otherwise there is a chance of arresting the vigorous nitrifying action that commences almost immediately after the first two or three loads of garbage are deposited in the cell.

Important advantages over other methods of disposal are low initial cost low operating and maintenance costs, absence of noxious odors due to operation, complete destruction of the pathogenic germs, its high revenue producing possibilities, and ease of enlargement of plant without disturbance of original unit, as the municipality grows.

Its disadvantage is that it is essential to maintain the three-can system which in some localities might introduce considerable difficulty in the collection phases. It is necessary also to make provision for the consuming of combustible waste, but in the complete plant design there should be no difficulty in incorporating this feature. Putting it broadly, a fermentation plant accomplishes in one month what the old compost heap took a year or more to do, and does it minus the nuisance.

As has been pointed out, garbage disposal by fermentation is not new, Italy has used it for 14 years. What is new is the adaptation of the process to American conditions, which differ vastly from those of Italy, and, therefore, present serious difficulties not faced there.

Acknowledgment.—The above paper was presented at the 9th Annual Conference of the International Association of Street Sanitation Officials.

Horn Controlled Traffic Signal

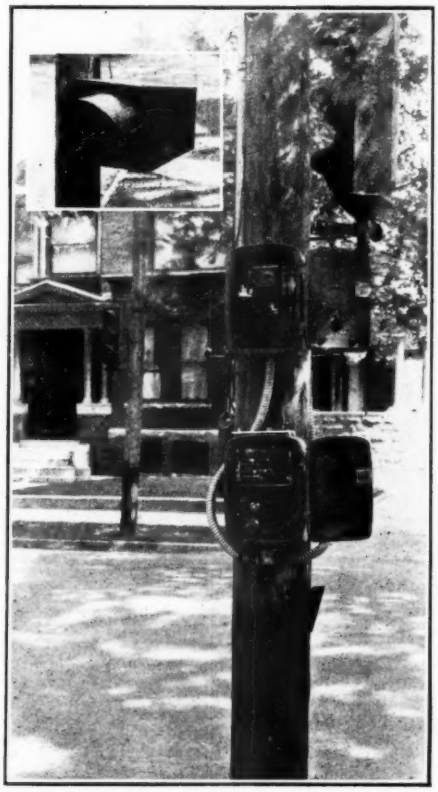
Sound and light assume a unique duty as traffic policeman in a new scheme of control whereby the operation of traffic lights at certain outlying intersections is to be placed in the hands of the traffic itself. Under this plan it is claimed vexatious halts at isolated intersections when there is no cross-traffic for which to halt will be entirely eliminated. And pedestrians, accustomed to taking their chances at street crossings, are also cared for; in addition to allowing cross traffic to interrupt main traffic. the new system enables pedestrians to obtain right of way by pushing a button.

The automobile horn is a vital factor in the plan, devised by Charles Adler, Jr., of Baltimore, and being introduced by the General Electric Company. The sound of the horn starts an electric sequence that changes the lights.

Approaching a much-traveled main artery, the motorist in the cross-street finds himself stopped at the street-intersection by a red signal-light, and knows, of course, that the signal-light on the main avenue is green. He halts his car near a horn-like contrivance mounted on a pole at the curb. He honks his auto-horn.

Immediately a sensitive microphone inside the sound-collector on the pole picks up the noise, converts it into an electrical impulse, transmits it by wire to a control-box, and which operates the mechanism to change the lights.

The first thing that happens is the appearance of an all amber light in the lens below or adjacent to the red light,



Horn-Controlled Traffic-Signal Installation at Schenectady

informing the motorist that his signal has registered. A moment later he gets his green light, a red light appears on the main thoroughfare, and the cross-street car secures the right of way.

After a premeditated interval, the lights change back from red to green on the main avenue and from green to red on the side street. The timing cycle operated by the sound-controlled device is completed shortly thereafter, main traffic retaining the uninterrupted right of way at that particular intersection until the next cross-bound vehicle appears.

In case a second motorist, travelling through the cross-street, reaches the intersection just after the lights have changed back to favor main traffic, he cannot immediately get the right of way, even though he blows his horn at the sound collector. He sees the amber light, indicating his signal has registered, but the red light against him continues until the timing cycle is finished, whereupon he also receives a green light, main traffic receiving a red light.

There is also provision for push-buttons on the poles, so that pedestrians can operate the system and obtain the right of way when desirous of crossing main-artery traffic.

Several initial installations of the device, known as the G-E novalux traffic-operated controller, are already under way. It is expected to be particularly useful at outlying street-intersections and upon country highways.

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State Aid for City Highways

In a very interesting letter, published in the December issue of ROADS AND STREETS, Mr. J. H. Howe, City Engineer of Cresco, Iowa, comments upon our editorial article, "Why States Should Build Pavements Through Towns."

Mr. Howe says: "Heroic efforts are being made to get the country roads out of the mud, while in the cities and towns we are still in the ox team days so far as any legislation calculated to speed up the construction of modern paved streets is concerned." This is true, and our editorial article emphasized one aspect of the legislative problem, namely a more equitable distribution of the cost burden. We are convinced that there will be inadequate progress until the practice of assessing street construction entirely against abutting property is discontinued.

Mr. Howe points out that the "city fathers" are usually less to blame than the state legislators for the prevalent injustice of laws relating to taxation for street improvement. He adds:

"Many members of the legislature seem to find it better and safer politics to neglect the cities and towns, but have them pay the bills. They talk farm relief but not city relief."

There is a growing irritation among city residents over the distribution of gasoline tax money, for example. They complain that in many states the residents of cities pay more than half the gasoline tax, but get only a very small percentage of the benefit derived from the tax. We predict that this complaint will grow in volume until state legislators do give adequate attention to "city relief." As a first step in that direction we urge the improving of "through streets" with money raised by gasoline and other motor vehicle taxes.

We agree heartily with Mr. Howe that if state-aid is thus extended to cities and towns, it should not be limited to building street pavements only 18 to 20 ft. wide. A city street should not be treated like a country road. If state-aid is extended to cities and towns, state highway departments may well delegate to city engineers much of the designing and construction supervision of state-aid streets. Co-operation, in short, is needed between state and city engineering forces.

We may have been too severe in our criticism of the seeming inertia of the "city fathers" relative to changes in the practice of assessing street improvements. Where they are hampered by state laws, the inertia is not theirs alone. Yet it rests mostly upon them to initiate efforts to change the state laws. Perhaps city engineers themselves are even more responsible for the inertia than are the "city fathers."

A city engineer should be more than a technical expert on construction and maintenance of city works. His is also the province—if he will but assume it—of advocating economic reforms even in laws. No one knows better the defects of a law than the men who have to conduct their work under its prescriptions and proscriptions. The city engineer sees such defects almost daily, and he chafes under them. But the old conception of an engineer as purely a technician usually prevents city engineers from aggressively advocating changes in laws, for that is supposed to be a job for legislators.

Engineers who, like Herbert Hoover, have risen to high executive positions, have usually taken a very broad view of the province of engineering. They have regarded all phases of their economic problems as being essentially engineering, regardless of the prevalent practice.

If engineering is the application of science to problems of economic service, engineers should not hesitate to extend their activities into the uttermost parts of the social realm. Certainly there is as much need of scientific study of the economic effects of laws and ordinances as of the scientific study of strains and stresses. Who, we ask, is better equipped for such study of political economics than is the engineer?

"Engineering Schools Should Teach Economics"

Under the title "Engineering Schools Should Teach Economics" a recent editorial article in an engineering magazine criticized some alleged errors of an engineer and placed the blame for his alleged mistakes upon his apparent lack of training in economics. We agree with the editorial opinion that engineering colleges should teach economics; but we think that the editor in question himself exemplifies the very lack of economic training that he deplores.

The first criticism of the engineer by this editor was that he used 7 per cent instead of using about 5 per cent in computing interest charges on a municipal pumping plant. This criticism was probably correct if the municipality could borrow money at 5 per cent without straining its credit. Not infrequently engineers of railways, on the other hand, make the mistake of using a bond interest rate of about 5 per cent instead of using a "fair return rate" of about 7 per cent.

The second criticism was that the engineer had used a 7 per cent annual depreciation rate; and this editorial statement was made: "Now, if a depreciation charge is set up, the invested capital decreases each year by this amount. Consequently, the interest should either be calculated on the basis of a diminishing capital or a diminishing depreciation."

Neither the premise nor the conclusion is correct. If a depreciation charge is set up and if a sinking fund is established to retire the plant at the end of its life, both the capital investment and the depreciation rate should be regarded as constant. This is the ideally correct treatment of depreciation where no change in price levels occurs. An approximately correct method consists in using a depreciation rate determined by dividing 100 by the estimated life in years, and in that case an approximately correct result is obtained when the invested capital is reduced each year by the amount of the annual depreciation found by multiplying the "straight-line" rate by the original cost (not the depreciated value) of the plant. On short lived property this approximate "straight-line" method is often satisfactory enough, but on a long lived plant it leads to very incorrect results, for it is tacitly based on the assumption that the depreciation annuity can earn no interest, which is clearly erroneous.

The third criticism of this engineer is even more clearly wrong than the second criticism, yet it exemplifies one of the commonest of economic blunders. Says the editor: "To make the situation still more illogical, when comparing the cost of operation of the present plant and purchased energy, this engineer ignored the fixed charges on the present plant when estimating the cost with purchased power, even though the investment still exists in the shut down plant."

Here we see that the critical editor regards the original cost of an obsolescent plant as being an element that must be considered in ascertaining whether it is cheaper to retire it or buy electric current from a central station. As a matter of fact it is wholly immaterial what the original plant did cost. The problem differs radically from one in which two alternative new and rebuilt plants are being compared economically, or from a problem in which the cost of generating power with a proposed new plant is being contrasted with the price at which such power can be purchased. In the case of an old plant that is obsolescent, the problem is really whether its obsolescence has progressed so far that its true economic value is less than its scrap value, or not. If not, it should continue to be operated, even though its true depreciated value be but little more than its scrap value.

Stated differently, the problem then is to ascertain whether the operating expense (exclusive of interest charges) per unit of power generated by the old plant is greater or less than the price per unit of purchasable power.

The problems of depreciation and the allied problem of when to retire an old plant or plant-unit, have been discussed in the "Handbook of Mechanical and Electrical Cost Data" by Gillette and Dana, to which the reader is referred for full proof of certain of the statements above given.

In the course of a rather extensive experience, the editor has found more ignorance among engineers on the problems above mentioned than on almost any other economic matter.

Because of ignorance of economic facts and principles hundreds of millions of dollars worth of plant have been retired too soon, and other hundreds of millions have been kept in service too long. To emphasize the seriousness of the whole matter, we have just quoted from a prominent engineering magazine a criticism of an engineer in which the editorial critic displayed his lack of understanding of certain principles involved.

It is apparently the opinion of the majority of teachers of engineering that there is no necessity of teaching economics as a special subject, and that all the principles of engineering economics can be learned incidentally as a sort of by-product of one or more of the engineering studies. It should not be difficult to test this opinion by submitting the fourth year students to a thorough examination in economics. It may be that the editor has been peculiarly unfortunate in having employed so many graduate engineers who could not pass such examinations.

Ask a number of such questions as this: How would you determine what rate of interest to use in capitalizing annual expenses? The answers that the editor has received have almost invariably shown no appreciation that it is a real problem itself to determine the correct percentage. Throughout Wellington's "Economic Theory of Railway Location" a bond interest rate is erroneously used to capitalize annual expenses and to estimate that part of fixed charges that relates to interest. In the original appraisal of the franchise value of the railways of Michigan and Wisconsin, a bond interest rate was erroneously used in capitalizing net earnings.

There seems to be prevalent the idea that if correct principles are applied it is a matter of minor concern whether the alleged facts are correct. Last year's net earnings, for example, are often assumed to be typical, without a thorough study to show what is a typical year's net. Depreciation rates are guessed at, although usually they may be ascertained with considerable accuracy from past accounting records that are properly interpreted. Here again very few engineers that the editor has encountered in rate cases know how to derive a depreciation rate from past accounting records; most of them asserting it to be impossible because in the earlier years no distinction at all was made between maintenance expenditures and retirement (depreciation) expenditures. The problem can be readily solved none the less.

Like any other subject that attains the rank of a separate branch of science, economics should be studied by itself. Unfortunately that particular branch of economics known as political economy has come to be regarded by many as being the only economics. For the most part it still remains a mass of unproved hypotheses and hot air. Business and engineering economics, on the other hand, have largely emerged from the stage of unproved hypotheses. Still the data that must be inserted in the formulas are often woefully unsatisfactory. The lives of many kinds of machinery and structures are usually guessed at. Interest rates are guessed at. Even unit cost prices are often guessed at. Overhead percentages are often guessed at. All this, too, by many engineers who would be shocked at hearing themselves called economic ignoramuses.

If this state of affairs is not traceable to the by-product treatment that economics has received in many engineering colleges, then what is the cause of it?

H. P. Gillette

The Personnel of a Water Department

How Detroit Provides for Its Employees

By JOS. F. MAJESKI

Paymaster and Personnel Superintendent, Department of Water Supply, Detroit, Mich.

IN the operation of the department of water supply, the city charter places all employees within the jurisdiction of a civil service commission. This commission acts in a capacity similar to the employment bureau of a private organization, furnishing upon request from the personnel superintendent all technical and clerical help which may be required in the course of operation of the department. The civil service commission, upon receipt of requisition, certifies the first person from a list composed of eligibles who have successfully passed a competitive examination for the position which is desired to be filled. Also, all changes that may affect a certified employee's status must be submitted to the civil service commission for approval. Employees have the privilege of protesting dismissal and suspensions and may, if desired, request a hearing before the civil service commission.

Therefore, it can be readily understood that the problems involving the personnel department of the water supply are the same as those confronting other similar municipal and private organizations. Material effect of questions arising, relating to the successful operation of this department must be considered carefully and judiciously the same as other problems which directly apply to the department of water supply.

A person certified to a position in the department, and upon entering, is required to fill out an employment record card containing name, address, telephone number and other data, which gives the department immediate information for record acknowledgment. These records are visibly typed and filed for instant reference, showing every transfer, promotion or change; in reality, giving a working history of the employee from the date of entrance into the department.

How Vacancies are Filled.—Inspiration to extend every effort for best results and co-operation in the department is instilled in all employees by the fair treatment accorded them. In the course of operation of such a vast department vacancies occur within the various bureaus. These positions are filled in so far as possible from the ranks of the existing personnel, thereby affording the individual to qualify for whatever promotion may occur as a result of transfers, dismissals, resignations or promotions. This procedure is followed, within the jurisdiction of the civil service commission, by filing an application setting forth his or her reasons as to their particular adaptability to perform the duties of the position which has become vacant or newly created. This application, with all other records of the employee already on file, is considered by the head of the bureau in which the vacancy occurs, and forwarded to the personnel superintendent for his approval and recommendation to the civil service commission, who has final jurisdiction in the matter.

The benefits realized by enabling employees to rise in the department by promotion or transfer creates a keener interest in their work as well as the spirit of competition, knowing that upon them depends every effort of success or failure, thereby encouraging and obtaining the best results for co-operation, and ultimately successful operation of the department.

Conditions provided for the betterment of the employees and for the consideration of their services are well taken care of by granting adequate periods for vacations and illness, as well as general environments.

Vacations and Sick Leaves.—All employees in the service of the department continuously for one year are allowed two weeks' vacation with pay. Time of vacation periods is apportioned by the head of the bureau in such manner so as not to impede the operation of the department. In case of illness, an employee is allowed as many as 15 days' leave with pay absorbed during the period of the year, or necessitated continuously. If an employee is compelled, by reason of serious illness, to absent himself or herself for more than the usual 15 days' sick leave, then with the discretion of the board, an additional 15 days is allowed with pay. Any employee absent by reason of illness or otherwise is required to notify the head of his or her bureau within 48 hours, stating reason for such absence and probable date of return. A physician's certificate must be furnished in case period of illness exceeds more than three days.

The Working Day.—The city charter provides that eight consecutive hours constitute a day's work and that six day of eight hours each constitutes a week's work. Overtime is paid per diem employees at the rate of time and one-half after the completion of the eight-hour day and double time on Sundays, provided they have already completed a full forty-eight hour week, or six consecutive days of eight hours per day.

The magnitude of the responsibility of the pay roll bureau can only be appreciated by the fact that from Jan. 1, 1927, to Dec. 31, 1927, this bureau paid out in salaries and wages the sum of $4,650,471.72. The weekly pay roll, made up for an average of about 2,200 employees, amounted to $3,623,372.75, while the semi-monthly pay roll for an approximate average of 477 employees amounted to $1,027,098.97 for the same period.

The above figures give one an understanding as to the accuracy, with several processes of checking, required in the detailed routine of the execution of this work.

The Pay Roll Bureau.—All timekeepers report to this bureau every Monday morning with their time sheets, which are in loose-leaf form, to be checked in the timekeeper's presence, as to names, titles, rates and extensions. Any change in title or rate, within the ruling of the department, must be authorized by the superintendent of the division which the timekeeper represents. The rates of pay in all cases are required to be within the standard adopted by the board in their respective classifications. When pay rolls are checked and completed, they are subscribed and sworn to by the head of each division or bureau before the personnel superintendent, who is a notary, and then submitted to the civil service commission for checking as to names and tiles, thereafter passed on to the city controller for verification of extensions, and finally to the city treasurer for preparation of the checks. Upon receipt of the checks from the city treasurer, they are checked and numbered by this bureau to correspond with the pay roll. After this procedure, they are then ready to be issued to the employees on pay day. Any employee receiving his check must furnish a signed pay ticket, showing such receipt, which ticket is given him by the timekeeper, who procures same from this bureau.

Provision is also made in this bureau for the handling of discharges and lay-offs. During the last year 688 employees were either discharged or laid off, necessitating the amount of $15,-402.52 to be paid out in cash. It has been the policy of this department to pay off employees immediately upon discharge or lay-off.

Handling Complaints.—The department of water supply in its operation also comes in contact with almost all the citizens, business and industries of the city. Considering the number and diversity of interests encountered, it is to be expected that a number of complaints will be made in the course of each year. These complaints are principally those regarding water and service charges, those regarding the personnel and those involving property. Minor complaints regarding charges for services are mostly adjusted by the billing department, but the more difficult complaints are adjusted by the adjustment committee, which is composed of four members, namely: the general manager, engineer of water system, chief clerk, and the personnel superintendent, which committee in turn makes their recommendation to the board of water commissioners for their approval.

All complaints against employees of the department are referred to the general manager and by him placed in the

hands of the personnel superintendent. These complaints, though few in number and of minor nature, are given a most searching investigation and if the employee is found to have been guilty of the charges made, he is severely disciplined. Complaints involving property are seldom made, as those in charge of the department's construction and maintenance divisions are most solicitous not to injure any property in the proximity of their work. If it becomes necessary to destroy lawns or walks in the course of operation, immediate steps are taken to repair the damage.

Accidents.—In a business as large as that conducted by the department of water supply, in spite of all precautions that are taken, accidents do occur, but they are mostly of a minor nature. In the first place considerable time of the personnel superintendent is devoted to looking after accidents in which the motor equipment of the water department is concerned. A written report is made out by the driver and forwarded to the personnel superintendent and by him reported to the superintendent of city motor traffic division, after which a date for hearing is set and all parties involved are notified to appear for hearing in the city council chamber. This department is represented at this hearing by its personnel superintendent, who has prepared himself by personal investigation of the facts of the accident. If the employee is found guilty of negligence he is disciplined and compelled to pay the damages caused. Other automobile accidents occur at times when a car is damaged by coming in contact with the department's construction or maintenance work. An automobile may be driven into a trench or over a pile of dirt or material that has been placed in the roadway. These cases are investigated and if the department is found at fault compensation is allowed for the damages sustained. The employee at fault in such cases is severely disciplined. There were 110 accidents for the year 1927 which were disposed of as follows: Twenty-five city drivers were found at fault; forty-two private parties at fault, and forty-three were unavoidable.

Accidents to employees are given a most searching investigation. These accidents are not very numerous and when occurring are usually of a slight nature. Fatal accidents or accidents occasioning total disability are of rare occurrence. During the year ending Dec. 31, 1927, there was a total of 408 accident cases handled by the personnel superintendent. Every accident, no matter how trivial, must be reported and on the eighth day after this report, together with such data as the name, address of both the employer and employee, occupation, age and sex, date and time of day when accident occurred and the nature and cause of the injury, length of time lost, date of return to work, the name and address of the physician and hospital, and the amount expended for hospital and medical care, must be submitted to the State Industrial Accident Board.

Accident Compensation.—The department of water supply, under the state law, does not pay compensation unless the employee is disabled for a period longer than seven days. When an employee is not able to return to his work after seven days, additional information must be furnished to the state board, covering the question of compensation for the injured employee. During the past year there were 39 compensable cases and 360 non-compensable cases, constituting 408 accidents to employees. The compensable cases receive 60 per cent of the weekly wage, the amount not to exceed $18 per week. Should an employee lose a limb through accident, a fixed time during which compensation must be paid is set by statute. The loss of a hand calls for the payment of the compensation for 150 weeks. Should death result through accident, the person's dependents are entitled to 300 weeks' compensation. The total amount paid during the year amounted to $6,124.88, distributed as follows: Compensation for minor injuries, $4,668.88; to widows of men who have lost their lives, $1,456. Besides the compensation, the department is responsible for a certain amount of medical attention and hospital expense in all cases. It is the personnel superintendent's duty to see that this provision of the law is scrupulously complied with. The sum of $9,047.90 was expended for hospitals, doctors and medicine during the year. The personnel superintendent, in making his reports, must be absolutely fair, in order, on one hand to protect the department, and, on the other hand to see to it that no injustice is done the employee in the time of his great need. All hearings that come up before the state accident board are attended by him. He also arranges all payments concerning matters of compensation.

Acknowledgment.—The foregoing is taken from a descriptive survey of the Detroit Department of Water Supply, issued last October by the Board of Water Commission.

Cost of Operating Ford Runabouts.—During the fiscal year ending June 30, 1928, the Water Department of Pasadena, Calif., operated 13 Ford runabouts. The average cost, according to the 13th annual report of the department, was as follows:

	Per Mile
Tires and tubes	$0.00614
Gas and oil	.01142
Other material	.00506
Labor	.00954
Overhead	.00252
Depreciation	.00205
Total	$0.03733

The average mileage was 7,731. The average mileage per gallon of gas was 15.02 and per gallon of oil 513. The average total number of hours in service during the year was 1,980 and the total cost per hour was 14.58 cts.

How Cities Can Make Use of Wasted Space

By E. E. DUFFY

Cities in the future must give more attention to the elimination of waste space.

Of the several conditions hampering cities, now that the automobile has complicated transportation problems, one of the most in need of corrective measures is the elimination of "Chinese Walls" accumulated through the construction of retaining walls and fills by electric and steam railroads. It has long been the custom in elevating railroad tracks to build parallel retaining walls, filling in between them with earth, with occasional openings at street intersections.

Traffic authorities point out that barriers formed by such construction are not in keeping with modern needs. Instances are cited to show that this space under the tracks can be utilized to the advantage of both railroads and the general public. Such space, frequently valued at $250 or more per running foot, can be made available through simple and economical construction of supporting columns and deck.

Three uses for this space are apparent; business, parking and automobile traffic arteries.

In the Wilson Ave. section of Chicago, space beneath the electric elevated lines has been successfully converted into business property. This improvement benefits both the railroads and the public.

An excellent example of the use of space that otherwise might be wasted is at the East Orange, N. J., station of a large railroad. Underneath the elevated tracks and near the station provision has been made for the parking of numerous cars.

Engineers point out that where four tracks are elevated, the ground space under the superstructure is about 60 ft. wide. With the proper spacing of the supporting columns, at least three cars can be parked for each 8-ft. length. The yearly income from this 8 ft. of land would be equivalent to the annual interest income from $3,000 to $4,000 and in addition motorists would have a convenient place to park.

This 60-ft. width could also be utilized as a thoroughfare for automobiles, with room for two or three traffic lanes traveling in each direction. With traffic congestion in many cities costing almost unbelievable sums, it is entirely logical to expect cities and railroads to co-operate for such usage, traffic planners declare.

Automatic Self-Cleaning Grit Chamber

A New Development for Sewage Disposal Plants

AN automatic, self-cleaning grit chamber designed for general use in place of the conventional grit settling troughs at sewage disposal plants has been introduced by The Dorr Co., New York. Its name, "Dorr Detritor," has been taken from the word "detritus," which is usually used to refer to the inorganics in sewage. This machine, it is stated, performs all the functions of the grit settling channels and in addition automatically collect and wash the grit, delivering it finally in a clean, dewatered condition to a suitable receptacle.

The plan and elevation views of a typical detritor installation are shown in Fig. 1. It will be noted that the detritor is located directly after the bar screen and consists essentially of four chief parts—a grit collecting tank, a collecting mechanism, a grit cleaning channel and a cleaning mechanism.

The collecting tank (Fig. 2) is square and shallow, the sewage entering along one side and being straightened out in parallel lines by a series of adjustable guide vanes or deflectors equally spaced along the influent side. The purpose of the collecting tank is to reduce the velocity of the incoming sewage to such an extent that practically all of the particles of grit of a predetermined size may settle out within the bounds of the tank. The sewage passes out of the tank across a weir which extends along the effluent side.

The collecting mechanism, a modification of the Dorr traction clarifier, consists of a combination of radial arms fitted with plow blades and an oscillating truss to which plow blades are attached. The radial arms sweep the area of the bottom bounded by a circle inscribed within the square tank, while the oscillating truss sweeps, in addition, the corners of the tank which are not reached by the radial arms. The mechanism is supported by a roller-mounted table on a central column. The oscillating truss, which is free to slide radially on the table, is attached at its outer end to a motor-driven carriage which runs on a rail on the tank top and drives the entire collecting mechanism. The plow blades move the grit outward toward the tank sides, where it is picked up by the buckets on the ends of the radial arms and deposited in the grit chute.

The chute discharges the grit into the narrow, rectangular inclined cleaning channel (Fig. 3) which extends from a point well below the water level at its lower end tor a point above water and adjacent to the grit container at its upper end. The cleaning mechanism has a reciprocating motion, the rakes

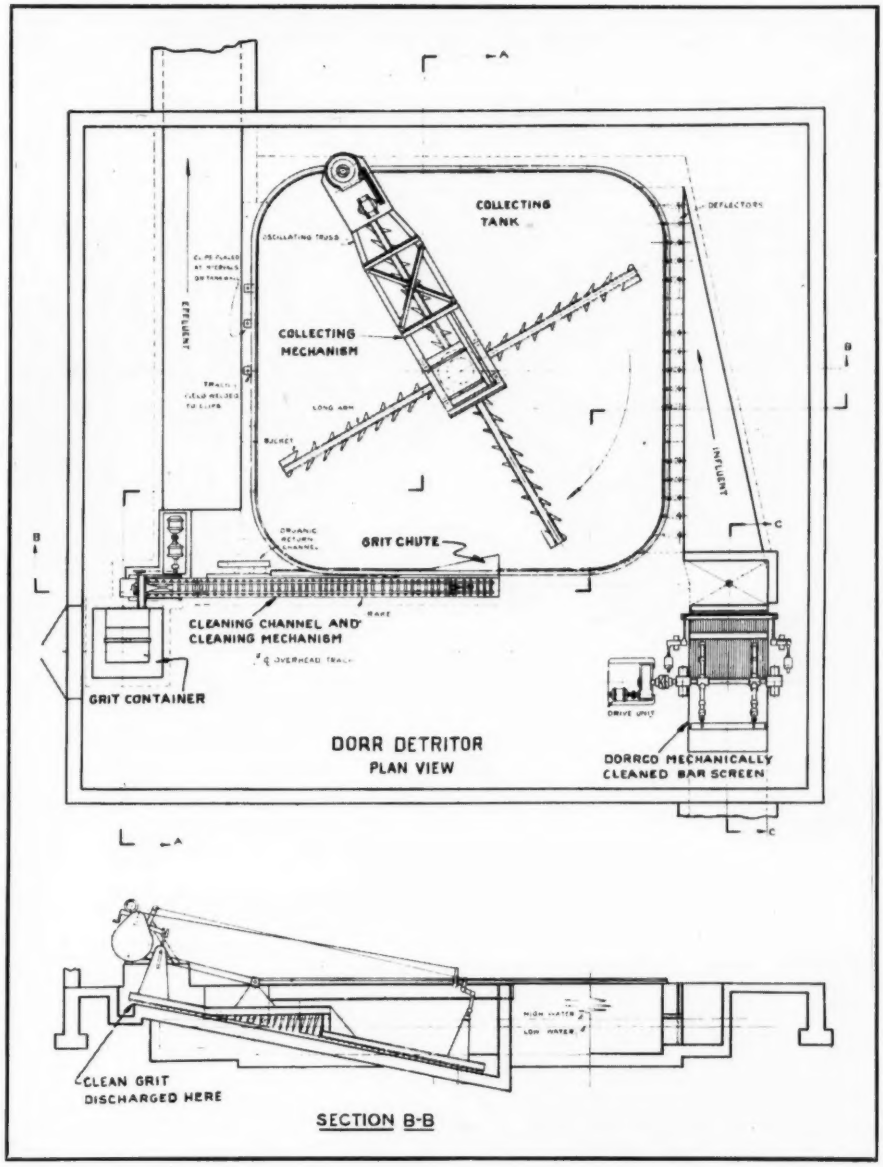


Fig. 1—Plan and Elevation of a Typical Dorr Detritor Installation

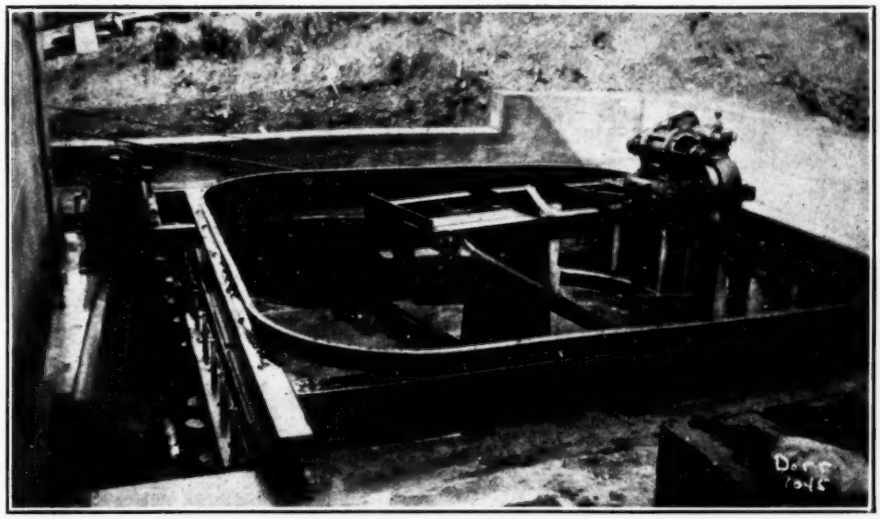


Fig. 2—Collecting Tank and Collecting Mechanism of Dorr Detritor

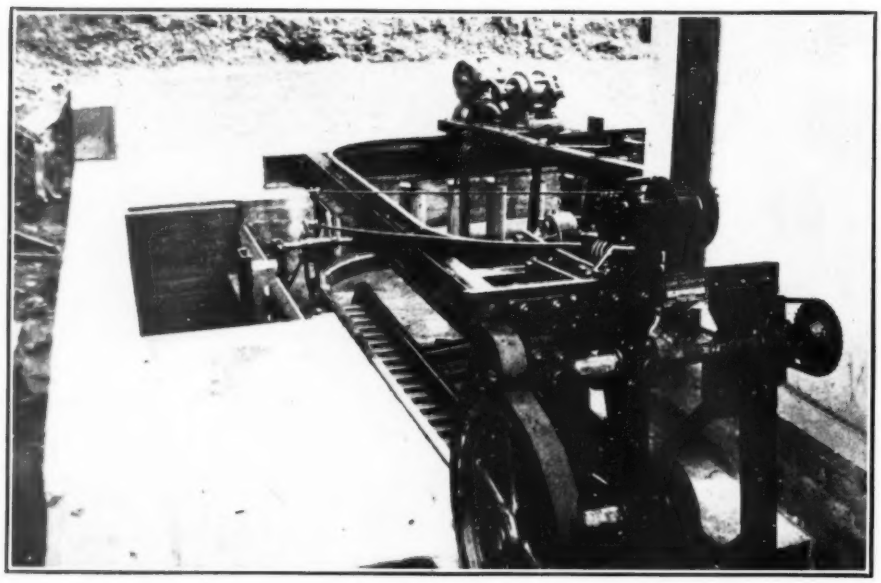


Fig. 3—Cleaning Channel and Cleaning Mechanism of Dorr Detritor

just clearing the inclined bottom and not only advancing the grit toward the point of discharge, but also imparting to it a turning over action which releases entrained organic matter. This released organic matter is kept in suspension by the gentle selective agitation of the cleaning mechanism and flows back into the collecting tank through an organic return channel in the dividing wall. This selective agitation, a result of the rake action over the inclined bottom, is stated to be just sufficient to wash back bulky organics but not the more dense sand grains.

The washed grit is drained on the above water section of the inclined channel and discharged into a grit container in a dewatered, odorless condition. As the grit is cleaned mechanically, it is unnecessary to maintain an exact velocity of flow across the collecting tank. While it is true that a velocity less than the maximum for which the machine is designed will cause the deposition of more organic matter with the grit, these organics are automatically removed subsequently in the cleaning channed and do not affect the character of the washed grit. Accordingly, duplicate units are not generally required for the control of velocity with varying volumes of sewage.

An extended test period at the initial commercial installation of the Dorr detritor is stated to have shown that the greater part of the grit of almost any fineness could be recovered and delivered to the containers with a putrescible organic content never exceeding 10 per cent and averaging over several months not over 5 per cent. That the washing has been carried out satisfactorily is evidenced by the present condition of the grit which has been recovered by the detritor over the last nine months at this plant. The grit has been exposed to the air ever since the equipment was put into operation, and in spite of exceedingly warm weather during the first few months, it is said, no obnoxious odors have been given off and there has been no evidence of a change of character that could be considered objectionable.

Nine Municipal Radio Stations in U. S.

Out of eleven municipal radio stations in the world, nine of them are located in the United States, one in South America, and one in Europe. Among those in the United States are: WPG, Atlantic City, N. J.; WCAM, Camden, N. J.; WRR, Dallas, Tex.; KGEW, Fort Morgan, Col.; WJAX, Jacksonville, Fla.; WCOA, Pensacola, Fla.; KKP, Seattle, Wash.; WNYC, New York City.

The New York station is operated by the Department of Plant and Structures of the New York City government, having been in operation for over four years, is the veteran among municipal stations. In 1927 over 1,689 hours were employed by this station in broadcasting; 720 hours were given over to vocal and instrumental music and nearly 1,000 hours to informational and educational programs; 320 balanced programs were given, including 80 lectures on municipal problems and 384 talks upon educational subjects.

WCOA, operated by the City of Pensacola, Fla., has been in operation only about three years and has given very great returns for the $7,600 a year which constitutes its budget. The officials at Pensacola believe that they are the only station which regards its main function as that of community building, developing local talent, encouraging young and aspiring musicians and players. Aside from this feature, they, like WNYC and WCAM, broadcast weather reports. These have been highly beneficial, especially to the fishing fleets sailing out of Pensacola.

In St. Louis the radio is used by police to broadcast news of major crimes. A private line connects the microphone on the desk of the chief of police with station WIL. This is to be followed up by installation of receiving sets in all station houses, and possibly in police atuomobiles. Detroit has also used the radio for some time in the police department.

In Baltimore the mayor's office has been outfitted as a broadcasting station so that meetings of the board of estimates and the board of awards may be heard from one's easy chair at the fireside. Conferences between delegations and the mayor will also be broadcast to those interested.

Airport Is Proper Municipal Function

The airport bonds approved by the voters of Kansas City and St. Louis, Missouri, last August were held invalid by the Missouri Supreme Court because of the cities' failure to revise the registration lists as required by law. The St. Louis issue was $2,000,000, and the Kansas City issue was $1,000,000.

At the same time, however, the court held that a municipal airport was a proper municipal function, saying:

"The courts which have had occasion to consider it have, however, answered in the affirmative; and no court of last resort, so far as we are advised, has ever held to the contrary. Not only that, but the function involved is given tacit recognition in numerous statutory enactments, both State and Federal. We have no doubt of the soundness of the view which obtains.

"With respect to the public uses which each subserves they are essentially of the same character. If the ownership and maintenance of one falls within the scope of municipal government, it would seem that the other must necessarily do so. We accordingly hold that the acquisition and control of an airport is a city purpose within the purview of general constitutional law."

Airports 3 Miles from Cities.—The average distance of airports from the business centers of municipalities in the United States is about three miles, according to a study made of such facilities in 436 cities by the Aeronautics Branch of the Department of Commerce. Considerable variety prevails, however, in the individual cases, some airports being within ¼ mile of the business district, and others being as far out as 18 miles. As might be expected, the larger the city the greater is usually the distance to its airport from the downtown section. In a number of municipalities of more than 100,000 population, the average distance to the airports was found to be approximately seven miles.

Water Works Improvements on the Cost Plus Basis

How an Iowa City Solved Its Reconstruction Problem

By H. V. PEDERSEN
Manager, Water Department, Marshalltown, Ia.

FEW managing boards of water works systems either municipally or privateiy owned are blessed with an over supply of funds for reconstruction purposes. In fact, it is common rather than exceptional for a water works department to be continually saving its surplus funds in order to retire bonds 15 to 20 years after an improvement has been made rather than to save them for future improvements. Wherever a city or private corporation has permitted its water works system to run down to a point where it must go heavily in debt to raise funds for necessary improvements, it takes a long time to get out of debt. It seldom ever does, for as soon as one bond issue is retired, the system is again in bad shape and because of lack of funds additional bonds are issued to raise the money for the improvement. In raising funds for water works improvements the private corporation cannot of course be compared directly with a municipality, but the same reluctance to spend money for reconstruction purposes exists in either case. As a rule it is comparatively easy to secure permission from either stock holder or the general public to raise funds for extension of mains, as most people readily understand that each additional block of new water mains increases the income from water rentals. In other words, there is less objection to spending money where the increased revenue will either pay for the improvement or bring a fair rate of interest on the money invested. A bond issue will usually be approved for raising funds to increase a supply of water whenever the public fully realizes that its supply is insufficient, but to tear down an old pumping station no matter how bad its condition may be and rebuild it is quite a different matter. As long as any public building hangs together it is difficult to make a majority vote in favor of a bond issue for reconstruction purposes.

It is this reluctance on the part of the public to believe that any city property, especially a water works system, should ever wear out which has compelled water works managements in many places to put off the evil day of reconstruction as long as possible and then when something must be done to prevent disaster to seek ways and means of getting by as cheaply as possible. The mere thought of a bond issue precipitates a fight and mud begins to fly in all directions, originating in most cases from sources least informed on the subject. Working on the assumption that a small bond issue will be approved more readily by the public than a larger one, the funds if secured at all are usually insufficient and the improvement suffers accordingly. Just how one Iowa city worked out its reconstruction problem might be of some interest.

Marshalltown Reconstruction Program.—The city of Marshalltown, Ia., was compelled to rebuild an original section of its pumping station this last summer. When the Board of Water Works Trustees first took the matter up for consideration it decided that no matter in how dangerous a condition the old building might be, there was little use in asking the public to vote on a bond issue. Every member agreed that, if there was any way to raise the money without a vote of the people, it was the thing to do, as they all felt that a bond issue would be defeated. A plan was finally worked out whereby a 2 mill levy authorized by state law and already received by the water department out of city taxes was pledged as security. A total sum of $50,000 was raised for water works improvements by practically mortgaging the water works property and pledging a certain definite source of income as security. No objections were raised to this plan and the bonds were issued and turned over to a bank for safe keeping to be sold only where the money was needed, thereby saving several hundred dollars of accrued interest.

The original water works pumping station at Marshalltown was built in 1876. This portion together with a number of later additions were in very bad shape. The walls were cracking and crumbling and the metal roof was practically eaten away. After careful investigation and study of the old structure it became apparent that a floor space area of 50 ft. wide and 130 ft. long had to be completely torn down and rebuilt while keeping the pumping units and boiler room in operation.

Cost Plus Plan.—After deliberation the Board of Trustees decided not to employ an outside architect and instructed its superintendent and general manager to prepare a set of plans and specifications. While investigating the condition of the old foundations and working out desirable changes, the writer became convinced that the probability of uncertain quantities which could not be determined until after the old structure had been torn down would make it extremely difficult to estimate the cost of the improvement. It was likewise believed that a contractor could not prepare an intelligently fair bid and would of necessity increase his estimated bid to take care of uncertainties. In order to insure a good job and at the same time keep the cost within a reasonable limit it was suggested that the work be done on a cost plus basis.

At first the idea of cost plus did not appeal to the members of the water board and one member was very definite in his objections. However, after each member had gone over the prepared plans and were shown the difficulties involved and after it had been pointed out that a limit could be placed on the contractor's plus they unanimously decided that money could in all probability be saved by doing the work on a cost plus basis. A contract was accordingly drawn up to fit conditions, extracts of which are as follows:

The first party (Water Department) agrees to place orders for, buy and pay for all materials necessary for the completion of this work.

The first party agrees to pay second party at the end of each week an amount equal to the second party's weekly payroll, on presentation of an itemized payroll sheet which shall be subject to check and approval by first party's water works manager.

The second party estimates the cost of rebuilding and reconstruction as defined by the plans and specifications at $..... and agrees to tear down the old building and rebuild it and dispose of all rubbish and do all of the work necessary to complete this contract as provided by the plans under the direction of said manager and in such a manner as will not interfere with the operation of the pumping units and boiler plant on a basis of such estimated cost plus $..... for his services and the use of his tools and equipment and it is agreed by the second party that if 10 per cent of the actual cost of material furnished and paid for by first party and labor furnished by second party and paid for by first party is less than the sum last above specified, then second party shall receive and be paid as compensation only 10 per cent of the actual cost. That in any event, the amount received by second party shall not exceed the sum of $..... above specified, notwithstanding the cost of the work, is greater than the estimate of $.....

Bidders blanks were prepared and bids called for. Instead of the contractor entering a bid for the total sum for which he would do the work, he simply stated the amount which he was willing to accept for his services and use of his equipment. A definite sum would be his clear profit in spite of the cost of the job.

Bids were opened on July 6, 1928, with four local contractors bidding. The estimates of the cost of the job ranged from $13,500 to $16,500 and the contractor's compensation from $1,200 to $1,500. The Board of Trustees considered the bids and awarded the contract to the contractor who they believed to have the best equipment for doing the work and who had also had the most experience. The estimated cost of the successful contractor was $16,000 and his compensation was to be $1,275.

Active work of tearing down and re-

construction began July 24 and continued until Oct. 1, 1928. A building 50 ft. wide and 100 ft. long together with a reinforced concrete coal room 25 by 50 and 22 ft. high, steel trussed roof spaced 16 ft. 10 in. on center, cost a total of $16,756.49. The materials cost $9,263.12 and the labor furnished by the contractor amounted to $3,961.35. Five masons, six carpenters and three laborers were the maximum employees furnished by the contractor at any one time. All the rest of the labor were supplied out of the regular water works employees.

The job progressed rapidly and was completed two weeks earlier than anticipated and a first class job was done in every respect. Marshalltown now has a well built pumping station of which it can be proud, at not too excessive a price. There are times when a straight contract has its advantages and is preferable, but when it comes to reconstruction the cost plus basis certainly works. If you have a questionable job, one which involves probabilities of extra quantities and desire first class construction, then buy your own materials and guarantee the contractor a definite profit.

Acknowledgment.—The above paper was presented before the Missouri Valley Section of the American Water Works Association.

Sewage Disposal in Mexico

An Outline of Present Sanitation Conditions

By ANASTASIO GUZMAN

MEXICO is just now beginning the development of sewage treatment methods. The chief cities have been provided with sewer system for a number of years, including Mexico City, which has a complete system that has merited the praise of many foreign engineers. The design of a sewer system which would be satisfactory in Mexico City was a very hard problem because of the nature of the soil and the flatness of the earth's surface. But by careful study and an expenditure of great sums of money, a satisfactory system was installed. Health conditions in that city as in others were noticeably improved with the use of sanitary sewer system.

Sanitation in Small Municipalities.—At present officials in many of the small cities and towns have become interested in the subject and the municipal governments have begun the preliminary work. Since most of the states are falling into line, we can say that the first part of our sanitary engineering problems is solved.

The above applies only to the building of sewer systems. With regard to treatment plants, we cannot say so much. In Mexico there is very little sewage treated. We dispose chiefly by dilution, which is the easiest method. The sewage is merely discharged without treatment into the streams which by themselves get rid of the sewage without causing any nuisance. The flow of the rivers is so great in comparison with the amount of sewage as to insure proper dilution. Of course these streams are never used for water supply purposes, but are frequently employed for irrigation. It must be remembered also that our streams are torrential, flow long distances and have many falls. In this way the sewage undergoes a natural process of purification. Our drinking water, as a rule, is derived from springs, artesian wells, and from rainfall collected in surface reservoirs, and we have always found these waters pure and good.

Combined Sewer Systems Common.—The sanitary and storm sewer systems are usually combined. In many small towns and villages, and especially those which are far from the principal cities, the use of the old primitive system of dry sewage is followed, which is bad. Some chemicals are used. In small private properties that cannot make connections with any sewer system, septic tanks are recommended. In some large factories the waste water is treated before being discharged into streams, and for such treatment small individual plants are installed. In one important city in the northern part of Mexico, there are large septic tanks, the effluent from which is used for irrigation.

Because of the many favorable natural conditions we have up to the present time been able to get along without sewage treatment, but these favorable conditions are now passed and sewage treatment is becoming indispensable. The small cities and villages are growing rapidly, the principal cities are enlarging their districts in the outskirts. In other words, the population is beginning to concentrate in cities just as in the United States. We have found, therefore, that in many places where the climate is delightful, people have crowded together until we find the water supplies being polluted. We are indeed beginning to feel a real need for adopting appropriate sewerage systems.

Conditions in Greater Part of Mexico.—Mexico City is a special case in itself, due to the great population which is growing daily, but in brief and general terms the conditions existing in the greater part of Mexico today are about as follows:

In the northern part of Mexico we have practically the same conditions as in the state of Texas; the climate, land and other circumstances closely resembling. The cities of this region are commercial and industrial. In the middle of the country and toward the western part, and in many places in the south, also, we have excellent climate without noticeable changes in temperature. There are many streams and the topography is broken—rather mountainous and rough—and from this we expect to obtain some advantage. On the coast and in the south, the climate is very warm, although the winters are very pleasant, and the changes in temperature will not give us any trouble. The principal sources of water supply are almost entirely independent of the rivers. One other factor which will help in making possible good sewer systems is the improvement in transportation and means of communication. We have a special commission on roads and highways which is now working constantly to extend good roads all over Mexico.

Although modern sanitary science is of recent development, and our problems in Mexico have arisen only recently, we have many experiences, works and studies from which to draw knowledge for future development. We hope to use some of the things which have been discovered in the United States and be able to skip over some of the mistakes made. In other words, sanitary work in Mexico can be started now upon a stable basis rather than having to go through the early stages of experimentation as has been done in the United States.

Only nine years ago did we begin to offer courses in sanitary engineering for the student of civil engineering, and these courses have been improved from year to year. We now have a curriculum which includes all that is covered in such courses in the United States and Germany. A few years ago the Board of Health of the Republic of Mexico undertook a great campaign to bring about the control of diseases, and to insure pure foods and drugs. The first meeting of the health officers of the various states in Mexico was held only last month. Through these meetings it is hoped to unify all these authorities just as you have done in Texas through the Texas Association of Sanitarians, and in the United States through the American Public Health Association. In the near future we hope to be able to establish in the various communities the necessary machinery to insure adequate protection of public health, welfare and happiness.

Acknowledgment.—The above is an abstract of a paper presented at the 6th Sanitation Short School, San Antonio, Tex.

Bond Issues for Sewerage and Water Works in Ohio.—Numerous municipalities in Ohio voted in November on bond issues for water supply and sewerage improvements. A total of $6,519,000 of bonds was authorized by 10 municipalities on water supply purposes, and a total of $2,203,000 was authorized by 8 municipalities for sewerage purposes.

Municipal Swimming Pools

Some Notes on the Water Supply Practice in the United States

By A. M. CRANE
Engineer, International Filter Co., Chicago

MUNICIPALITIES are competing with amusement parks and providing pools holding one, two and three million gallons. This is quite a draft on the municipal supply—unless refiltration be employed. The majority of wading pools do not use refiltration but are supplied with a constant flow of new water. This must mean something even in a city as large as Dallas. There they have about 20 wading pools, most of them about 30 ft. by 50 ft. in area. So the water demand is something which concerns the water works man, even if he is not called upon for advice in the planning of the pool. But in many cases he is called upon, and this is as it should be.

State Laws on Bathing in Potable Waters.—A few months ago, the writer, acting for the American Association for Promoting Hygiene and Public Baths, addressed an inquiry on this subject to the health authorities of our 53 states, territories, and island possessions and the result is given in the 1928 Journal of the Association under the title: "Promoting Pools by Prohibiting Bathing in waters Used for Domestic Purposes." This shows that actual state prohibition of bathing in domestic water supplies exists in California, Connecticut, Massachusetts and New York.

Kansas and Maine and perhaps other states have the authority, but have not enacted regulation. In Montana and probably other states, there is no specific enactment; but it is prohibited under general laws governing sanitation of surface waters. In Illinois, Louisiana, Maine, New Mexico and doubtless elsewhere, it may be, and is, prohibited by city ordinance or water company charter.

Down in Texas, a recent court decision restrained the use of a swimming pool in the Navasota River because it emptied into and polluted the lake of water impounded for domestic use by the city of Grosbeck. The California State Board of Health's swimming pool rules expressly state: "Disposal of swimming pool water can not be into a drinking water supply." But, on March 23, 1927, New Jersey set a horrible example by nullifying a regulation of the state department of health and enacting a statute specifically granting the right to bathe in any of the fresh waters of the state. This statute reads:

"It shall be lawful to bathe or swim in any of the fresh waters of this state, provided, that in so doing no trespassing be committed."

Of course this is all part of the broad subject of stream pollution; but while seeking to prevent contamination by sewage and industrial wastes, it will be well to remember that excretions from one typhoid patient might start a first class epidemic.

Now, if we can't bathe in the river or the reservoir—and we shouldn't bathe in the river or the reservoir—then we must have pools. And as the cry is not only for more pools, but for bigger and better pools—the whole subject is of vital interest to the city engineer and water superintendent.

Earlier Pools in U. S.—The earliest pools in this country were merely enclosures in the rivers. Then scows were used. In 1915 New York added a refinement by making its floating baths watertight—so as to prevent seepage, and supplied them with water from the city mains.

Indoor public baths came into use in Philadelphia in the eighties. In these, the pool area was not roofed. Consequently they could not be used in cold weather.

According to the late Dr. Simon Baruch, who is credited with being the founder of the public bath movement in the United States, in 1900 there were only 67 public pools in this country.

In 1913, the writer located only 540 pools in the whole United States. Of these 250 reported their dimensions. They ranged from 10 ft. by 20 ft. to 65 ft. by 140 ft.

The popularity of the pool has grown to such an extent that the first class ocean liner is incomplete without one. Right at this moment the United States shipping board is installing them on the former German ships "Monticello" and "Mount Vernon."

In the U. S. army, 59 establishments have pools—the largest entirely artificial one being 55 ft. by 169 ft. at Camp Harry J. Jones, Arizona.

It is the increasing size of the present-day pool and the state requirements as to water supply that makes the subject of particular interest to the waterworks man.

While 15 years ago a 65 ft. by 140 ft. pool was considered a large one, to-day the pools in our parks are rapidly approaching those of ancient Rome.

Increase in Municipal Pools.—Today cities are vying with amusement parks in building artificial pools which would take the entire output of a small town water works.

For example: The pool which is to be built for Elizabeth, N. J., will be nearly as large as Magner's Pool at Rye, N. Y., which holds 502,000 gal.; and the municipal pool at Estherville, Iowa, holding 375,000 gal. is nearly in this class. East Cleveland's municipal pool, holding 500,000 gal., is almost in the class of the nearby Idora Amusement Park pool at Youngstown, Ohio, which holds 740,000 gal. There are several other municipal pools now being planned which will run as large or larger than Chester Amusement Park at Cincinnati, which has a capacity of nearly 1½ million gallons.

In 1915 the American Association for Promoting Hygiene and Public Baths adopted suggested standards for swimming pools, including one reading as follows:

"Unless there is a constantly inflowing stream of absolutely pure, clear, colorless, fresh water, this condition should be approximated by filtration, refiltration and disinfection."

State Regulation of Swimming Pools.—At that time only one state—Louisiana—had any regulations and they did not go into details of the water supply; but now 27 states have definite and arbitrary regulations and 21 states require that plans must be submitted, or a permit secured, or the pool registered with, or reports made to the state board or department of health.

There has been a wide divergence in the state regulations but they are becoming more uniform since the promulgation of the report of the joint committee on bathing places of the American Public Health Association and the conference of state sanitary engineers.

Thirteen states now specify a definite degree of bacterial purity. Of late the tendency has been to stipulate the results, rather than to specify the means thereto.

New Mexico is a good example of this. Formerly they required 800 to 2,000 gals. per bather; now they do not specify any quantity of water but limit the bacteria content to the U. S. treasury department standards for drinking water. But several states still require a definite quantity. California wants 1,000 gals. of new water for each bather in "fill and draw" pools, to which they and other authorities are opposed. (California recommends circulation and refiltration daily.) Kansas requires and South Dakota recommends—1,000 gals. for each 15 persons using the pool during any period of time. This is equal to 66 2-3 gals. per bather. Virginia cut down its former recommendation of 500 to 800 gals. to 100 gals. per bather, and is now being guided by the joint committee's report. The "suggestions" of Georgia name 600 gals. per bather as the desirable quantity.

For "fill and draw" pools, Arkansas, Florida, Mississippi, Tennessee, Washington and Wyoming are satisfied with the "weekly bathing load of 20 in." (equal to 50 gals. per bather), suggested by the joint committee, but "prefer" a constant flow of new or refiltered water equal to "400 gals. per person per day considered on an average daily attendance." Oklahoma absolutely requires 400 gals. per bather both for "fill and draw" pools and those where refiltration is employed.

Use of Refiltered Water.—Of course if the demands either as to quantity of water or degree of purity had to be

met by a constant flow of water from the city mains, there would be fewer pools.

But refiltration makes it possible to use the initial supply (with a daily "make-up") for weeks or months without emptying the pool. The writer's survey in 1913 disclosed only 54 out of 272 pools employing refiltration. Today refiltration is universal. There may be a few city fathers who can't see why they should spend money for filters for the park pool just after they have paid for a city filtration plant; but they are getting fewer every day. When refiltration was first practiced—about 20 years ago, it was chiefly in indoor pools and to conserve the water and heat. Today, health is the primary reason for refiltration—although without it, the cost of operation would prohibit pools in many places.

Refiltration not only conserves water and heat, but keeps down the contamination of the water by the bathers.

Diseases from Unfiltered Pools.—In 1915 Dr. Manheimer cited 19 authorities who had reported venereal, ocular, aural or intestinal diseases contracted from swimming in polluted water. In 1929, Professor Hinman, one of the foremost investigators of the subject, tabulated the diseases as follows:

1. Intestinal infections, such as typhoid fever, dysentary, etc.
2. Infections of the respiratory system such as gripps, colds, sore throat and sinus infections.
3. Eye and ear infections, such as conjunctivitis, rhinitis, and ethmoiditis.
4. Gonorrheal infections.
5. Skin infections.

Reports of infections contracted by children in wading pools and tests showing highly contaminated water, have impelled the American Association for Promoting Hygiene and Public Baths to undertake an investigation of this subject. So far we have received reports from 87 pools and these show that the average area is as large as the swimming pools reported in our survey of 15 years ago, although the average maximum depth is necessarily lower, this being 20 in.

In the majority of these wading pools it seems as if there is a constant inflow while the pool is in use.

Out of 54 of these pools, 30 of them refill daily, two, twice a day, three, four times a week, six, three times a week, six, twice a week, and seven, once a week.

It remains to be seen whether or not the A. P. H. A. and state sanitary engineers will take cognizance of the situation; but a number of the members of both organizations have expressed themselves in agreement with our feeling that authorities should ordain the same standards of purity for wading pools as for other "Bathing Places."

Of course it would be quite unnecessary to go into structural details which should be left to the architect or engineer; and it would be impracticable and prevent an increase in wading pools to require a pre-cleaning shower; but the lack of a "scrub" and the fact that many of the youngsters wear dirty clothes which are immersed in the pool, making imperative a constant flow of pure water.

The sum total of this whole argument is:

1. The increasing size and growing number of swimming pools and wading pools demand the interest of waterworks men.

2. So far as purity of water supply is concerned, both swimming pools and wading pools should be considered on the same basis.

3. Unless there is a constant inflow of pure new water, this should be approximated by refiltration and disinfection.

Use of Dye in Underground Leakage Surveys

A dye test method of locating underground leakage has been used with excellent results by the Underground Leakage Section of the Department of Public Works of Chicago. The method was developed for use where the mains are at extreme depths below the street and where the mains lie in water bearing soil. This condition exists particularly in South Chicago where many mains are at depths varying from 11 to 12 feet below the present street level. Mains in this section of the city were laid in marshy ground 40 to 50 years ago and the street grades were gradually raised until the water mains and services are at the depths stated above in soil which is constantly filled with water. The mains and service pipes up to the stopcock are invariably covered with water or are water bound, in which condition very little or no sound is transmitted by the leaking water. The locating of underground leaks under such conditions is almost impossible when ordinary methods are resorted to. The dye method of testing to determine the location of leaks under such conditions was developed by William B. Weldon and Leonard Mauel who have been in direct charge of the field parties on this work. The method may be briefly described as follows:

After a section of main has been isolated and the service pipes shut off, when leakage is indicated, a vegetable dye (fuchsine) which colors the water red is passed into the pipe at the location of the by-passed valve. This dye is contained in a tank under sufficient pressure so that it can be forced into the main under test. The rate in feet per second at which the dye colored water in the main is moving can be determined by considering the cross section of the main and the volume of water being recorded by the master meter. After this rate has been determined the service pipe is disconnected at the first house meter and the water is drawn off in a volume equal to the contents of the service pipe. If the dye has reached this point in the computed time, the water is shut off on the service pipe and the next service pipe opened and similarly tested. When a point is reached where the dye does not come through the service pipe in the computed time, it is necessary to draw off the uncolored water until the dye-colored water appears. The water thus drawn off is measured and when the volume of the same is divided by the area of the cross section of the pipe the distance from the service pipe under test back to the point of the leak is determined. In this way the location of an underground leak can be determined without the use of sound instruments or without excavating at random. This method has been used very successfully in the South Chicago district.

The dye test method was used in 45 sections and on some of these the test had to be repeated two or three times because of distributed leaks. In 25 of the 45 sections the leakage located amounted to 583,911 g.p.d. In 20 other sections 285,164 g.p.d. was located.

Motor Vehicle Operation by Water and Power Commissioners of Los Angeles.—According to the 27th annual report of the Board of Water and Power Commissioners of Los Angeles, Calif., for the fiscal year ending June 30 last, the board had a fleet of 512 motor vehicles, consisting of 175 trucks, 143 work cars and 194 automobiles. In addition there were 28 trailers and 18 pieces of equipment mounted on trucks, such as air compressors, hoists, pumps, electric welders and fuel tanks; also 152 pieces of construction equipment of various kinds used in the construction and operation of the works. The total mileage run by the fleet during the past year was 5,313,365 miles or 10,377.6 car miles. Trucks made a total of 1,362,912 miles, which is an average of 7,447.6 miles per truck, with the total miles run by the automobiles and work cars was 3,950,453 miles, which is equivalent to 11,253.5 miles per car. The average cost per car mile for the automobiles operated last year was 5.7 cts. and for the trucks 18.5 cts., as compared with a 6-year mean of 5.9 cts. and 18.8 cts. respectively. The total miles run this fiscal year exceeds last year by 564,946 miles.

Airport Survey in Michigan.—The League of Michigan Municipalities is undertaking an airport survey of the state for the purpose of ascertaining the number of airports, stages of development, method of financing, management and progress where development has been urged.

Water Works Records

How Detroit Keeps Records of Its Distribution System

By CLARENCE W. WRIGHT
Assistant Civil Engineer, Department of Water Supply, Detroit, Mich.

ONE of the purposes of the engineering bureau is to procure and preserve accurate records of all work done in connection with the distribution system. This system consists of all pipes used for the carrying of water from the pumping station to the streets or alleys adjoining each home or commercial enterprise. Orders to lay pipe are all numbered and divided into four classes, "A," "B," "C" and "D."

The "A" jobs are those recommended by the department and consists of the laying of mains above 16 in., replacements, the lowering of mains where necessary in streets to be paved or resurfaced, and mains laid to furnish better fire protection.

The Pipe Laying Budget.—At the time the annual budget is made up, a list is prepared of all mains 16 in. and larger which it is desired to lay during the following fiscal year. When the budget is finally approved, a revision of this list is made, based upon the amount of money available for large mains. This list is then submitted to the board for approval. Following this, plans and profiles are prepared, and the lines are laid as soon as practicable.

At the beginning of each year the department of public works publishes a list of streets and alleys it intends to pave or resurface during the following year. An investigation is immediately made to determine what work must be done in these streets during the coming year. It has been the policy of the department to replace all 4-in. mains with 8-in. or larger. As soon as notice is received of the intention of the department of public works to pave or resurface a street in which there is a 4-in. main, this main is immediately ordered killed and a larger main is ordered laid to replace it. The old mains are removed wherever convenient. Otherwise, the service connections are transferred to the new mains, the connections to other mains are cut off and the mains are abandoned. The depth of service mains in streets to be resurfaced is measured at each gate, or wherever opportunity affords. In case such mains are found to be so shallow that service connections are liable to freeze, the main is either lowered or replaced, or the service connections are lowered.

Work Preliminary to Paving.—Before paving contracts are let by the department of public works, photostat copies of the plans and profiles are sent to the department. Depths are taken by the maintenance division on all water pipes in the streets. The profiles are then returned to the engineering division and the pipes ordered lowered wherever the future grade of the street will give the pipe less than 4½ ft. of cover. It has been necessary to lower considerable pipe which was originally laid in territory outside the city limits, and which has since been annexed to the city. It is for this reason that the inspection of pipe laid outside the present corporate limits, but connected to the Detroit system, is so rigid. Grades are given on all pipe lines 24 in. and larger and wherever necessary on lowering jobs. The remainder of the pipe is laid on an even grade with a minimum cover of 5 ft. in paved streets and 6 ft. in unpaved streets. Street lines are located for the foreman wherever necessary, but this is required only in undeveloped subdivisions.

Much of the water pipe laid in the various sections before annexation to Detroit was of insufficient size and was placed in the alleys or easements. Hydrants could not be placed in locations which would provide adequate fire protection. These mains have therefore been replaced by larger pipes laid in the streets. These new mains have been ordered by forced petition by the Board of Water Commissioners.

All pipe laying jobs ordered upon petition are known as "B" jobs.

Laying Extensions.—If a man owns a lot located inside the city limits and desires water, he need only come to the office of the department of water supply, sign a petition requesting that pipe be laid to supply his lot, pay 75 ct. per foot of frontage served, and the department will, at its earliest convenience, lay a main past the front of his lot. This work is done under city ordinance. As soon as a petition is received, a plan is made showing the pipe it will be necessary to lay in order to supply the petitioner with water. This plan shows the size of pipe to be laid, the location in the street of the proposed line, and the location and size of all specials and gates. The scale used, 1 in. equals 100 ft., is sufficiently large to give this information since most extensions are made in the outlying districts.

A resolution is then passed by the board of water commissioners and the common council declaring the main necessary and ordering the work done.

An assessment roll is next prepared, assessing 75 ct. per foot of frontage against each lot which may obtain water from the new main. No charge is made where a main runs past the side of a lot, but acreage is assessed on all frontages.

An advertisement is published five times in a daily newspaper stating that the roll will be in the assessors' office for 12 days from date of the first publication.

The roll goes to the common council which either confirms it or orders it revised. If confirmed, the assessment becomes a lien against the property assessed and the roll goes to the city treasurer for collection.

The treasurer then advertises the roll in two newspapers once each week for three successive weeks, that the assessments are payable within 60 days from the first notice. Bills are also mailed to each person on the roll. If the assessment is not paid in 60 days, a penalty of 1 per cent per month is added for six months in addition to six per cent interest.

The real estate may then be sold for unpaid assessments in the same manner as in the case of sales for non-payment of general taxes.

After the water pipe is laid no owner is allowed to have a service until the assessment against his lot is paid.

Work Beyond City Limits.—The "C" jobs are beyond the city limits. If a subdivision or village outside of Detroit desires to lay mains in which Detroit water is to be furnished, they must first present a pipe layout for approval as to size of main and location of gate valves. When this is approved and an agreement is signed, and an inspection fee of 3½ct. per foot is paid, the contractor may begin work. An inspector is placed on the job who protects this department as to workmanship and depth of pipe.

All jobs where the cost of the work is billed to outside organizations are known as "D" jobs. This includes the changing of water mains for the construction of sewers, grade separations, etc.

Sketches are made in the field of all pipe laid, lowered or discontinued. Dietzgen's engineers' field book No. 400 is used for this purpose. Loose-leaf field books were tried for a time, the sheets being later bound, but it was found that sheets were either mislaid or destroyed, and valuable records were lost. It was also found that there was a tendency to merely make notes or temporary sketches in the field and to make the permanent sketches in the office. The final sketches so made were a little neater, but they were much more inaccurate and there was considerable danger on an engineer trusting to his memory to retain details. Frequently no sketches were made of small jobs because the sketchers had mixed these notes with notes of larger jobs.

By making his sketches on the job the engineer can see immediately what measurements are necessary, and he can get them at once. There is no danger of his forgetting such things as which way the pipe swings or where the swing begins and ends. Small matters, such as whether gates are in wells or boxes, are not missed. The engineer is required to check the measured length of the line against the foreman's pipe record, and to check the specials sketched against those shown on the pipe record. In this way many errors are eliminated as differences between the sketch and the pipe record can be checked by looking at the pipe in the ground. It has been the plan of the engineering bureau to have the sketch-

ers see all the pipe in the ground. This may mean that the sketcher will have to make several extra trips. He can, however, sketch the work as it progresses and thus avoid errors which would creep in were he to wait until the completion of the job before making any sketches.

Recording Pipe Lines, Etc.—The bureau keeps engineering records of pipe laid outside of the city but connected with the Detroit system, just as it does for its own pipe. This applies to villages receiving water from Detroit as well as to outlying subdivisions. All records of pipe laid are filed under north and south streets. Under each north and south street is further indexed all intersecting streets. Two important streets, Gratiot and Grand River Aves., which run at an angle with true north, are treated as north and south streets. Three sets of maps are used for recording pipe lines: intersection maps, section maps and distribution maps.

A map is made on tracing cloth of each street intersection, to a scale of 1 in. equals 16 ft. Alleys in which there are pipe lines are shown on the intersection of the street nearest. On these maps are shown all the details of the piping system. All locations are given from the property lines. Curbs are shown but sidewalks are not. Sewers, gas lines, conduits, etc., are shown wherever the water mains intersect them. These sheets are 20x21 in. and are bound loose-leaf fashion in sets of 20 to 40 sheets. This makes readily available all information regarding location and size of mains, gates, connections, etc.

Sectional Maps.—The sectional map of the city is drawn to a scale of 1 in. equals 300 ft. The sheets are 20x21 in. and are bound loose-leaf fashion. On this map is posted all distribution pipe. All gates, blow-offs and private sleeve and valve connections, hydrants and cisterns are also indicated. Solid lines only are used to indicate pipe lines, the width of the lines indicating approximately the size of the main. The sizes of all mains and many of their locations are also marked on them. The first of every year approximately 100 blue print copies are made and one copy is given to every foreman, leak investigator and tapper.

The city of Detroit and the surrounding territory is also shown on a map which is drawn to a scale of 1 in. equals 1,000 ft. This map is made up of 15 sections and is known as a distribution map. On it is shown all mains and gate valves and their sizes.

The sources of information as to the sizes of lots, widths of streets, names of subdivisions, etc., are the topographical maps, copies of recorded plats and real estate atlases.

The topographical maps are prepared by the city engineer's office and now cover the whole city. They are printed on cloth to a scale of 1 in. equals 200 ft.

Photostat copies of recorded plates are secured from the tract index office of Wayne County.

The increase in area of the city of Detroit has been 56.7 square miles in the last six years. During the same period the water system has grown from 1,647 miles to 3,401 miles, or an increase of 1,754 miles. This includes all areas furnished with Detroit water.

This increase in the volume of work has temporarily resulted in our permament records not being up-to-date. The relief from additional annexations within the last two years has lessened the demand for new mains and the engineering bureau is now in a position to make a gain in its permanent records.

Acknowledgment.—The foregoing is taken from a descriptive survey of the Department of Water Supply of Detroit, Mich., issued Oct. 1 by the Board of Water Commissioners.

Missouri Conference on Water Purification

The Missouri Conference on Water Purification held its fourth and most successful meeting at Hannibal, Nov. 15, 16 and 17. Interest in the program was evinced by the attendance of 75 members and guests and by the lively discussions which followed the presentation of all papers.

The Missouri Conference on Water Purification was organized by the State Board of Health for the purpose of providing an opportunity for those in charge of municipal water purification to become more closely affiliated and better qualified for their work. The hopes for the service which this organization could render in the production of safer municipal water supplies and better protection of the public health have been amply realized. Largely through the efforts of the organization, a marked improvement has been made in the operation of water purification plants in the state and an increased sense of responsibility has been developed among those in charge of the production of a commodity which is of the utmost importance to the public health.

Several changes were made in the constitution of the Conference. The name was changed to Missouri Water and Sewerage Conference in order to indicate that the present scope of interest included municipal sewerage as well as water systems. Provision was also made for affiliation of the Conference with the Federation of Sewage Works Associations.

The time and place of next year's meeting will be determined by the incoming Executive Committee. Following are the officers elected for the ensuing year:

Chairman—C. E. Heflin, Water Commissioner, Cameron, Mo.

Vice-Chairman—S. J. Duncan, Superintendent, Waterworks, Moberly, Mo.

Secretary-Treasurer—H. D. Peters, Assistant Engineer, State Board of Health of Missouri.

Executive Committee—W. V. Weir, Assistant Manager, St. Louis County Water Company, University City, Mo.; E. E. Wolfe, City Chemist, Hannibal, Mo.; W. P. Britain, Superintendent, Waterworks, West Plains, Mo.; J. N. Wells, Superintendent, Joplin Water Works Company, Joplin, Mo.

Index for A. S. T. M. Standards

The American Society for Testing materials, 1315 Spruce St., Philadelphia, Pa., has issued a pamphlet containing an index to all A. S. T. M. standards and tentative standards. The number of these standards and tentative standards has increased to such a degree (548 in all) that a complete index was deemed desirable and accordingly the present index was compiled in addition to the individual indexes appearing in the society's books of standards. The index will be a valuable aid in ascertaining whether the A. S. T. M. has prepared a specification or test covering a given material, and if so, its title and serial designation and where it is published in its lowest form. The index now becomes a permanent annual publication of the society.

Water Consumption in Los Angeles, Calif.—The mean water consumption in the city of Los Angeles, Calif., for the fiscal year ending June 30, 1928, was 323.3 second feet, of which 98.2 second feet was for irrigation purposes. The mean summer consumption was 428.8 second feet, of which 254.5 was domestic. The mean winter consumption was 221.9 second feet, 195.8 being domestic. The peak consumption was in July, 1927, the total being 542 second feet, of which 282 was domestic.

Traffic Survey for New York City.—New York City has engaged the services of Day & Zimmermann to make a survey of traffic congestion in the five boroughs of the city, including commuter traffic to New Jersey. It is intended that the studies made by private organizations, such as the Regional Plan of New York, and all data gathered by such city departments as police, and plant and structures shall be used. Rapid transit problems are not included in the traffic study.

County Parks Show Profit.—According to the report of the county park commission, parks in Westchester County, New York, made a profit for the county of approximately $175,000, and in addition created wealth for the county through assessed valuations amounting to $125,000,000 during the past year.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Badger Meter Mfg. Co. Has Biggest Year—Holds Its Annual Sales Meeting

THE accomplishments of the company during 1928 were the key notes of the annual sales meeting of the Badger Meter Mfg. Company, which was recently held in its home office at Milwaukee, Wis. The officials of the company pointed out the strides made during the past year, and also stated that 1928 was the biggest year in the history of the company, which is now in its 26th year. This was duly credited to increased manufacturing space and facilities, additional sales representatives, and a more complete line of water meters.

During the year 1928, the company made an addition to the plant which covered a half block square, giving it an increased floor space of 45,000 sq. ft. in the manufacturing and assembling buildings. Besides this addition a new brass foundry was constructed, having 15,000 sq. ft. of floor space and equipped in the newest and latest type of machines, which makes this foundry one of the most outstanding of its kind in the field.

What News

Coming first by runner, and horse and rider, then stage-coach, steam-car, telegram, cable, down to the days of wireless and airplane, from North—East—West—South, NEWS has been eagerly watched for by a waiting world. The little world watching for the NEWS we have to give is just as eager to know of the happenings in the engineering field—how the output of the manufacturer is increasing and how the distributor is handling it. And, to be a worthy distributor of this information it must come to us from all four quarters — North — East — West — South,—how else could it be NEWS.

Wherever you are, let us tell your news to our engineering world. Anything that is of interest to the growth and welfare of your business, is of interest to us. Send your stories and pictures to The Editor, Distributor News, Gillette Publishing Co., 221 East 20th Street, Chicago.

During the past year some new models were added in order to give Badger Meter a complete line, which new line includes a size and type for all service, from the little ⅝ in. disc meter to the large 12-in. turbine. In accomplishing this the company redesigned its line of compound meters, which now range in sizes from 2 in. to 8 in., complying fully in detail with the American Water Works Association and the New England Water Works Association's standards with reference to laying lengths, likewise establishing capacities averaging 25 per cent greater than standard specifications demand. In addition to this, it reduces the net weight of all sizes of this type of meter on an average of 50 per cent through special cast-iron processes developed, this because of greater tensile strength. Naturally, it makes for increased ease of handling on installations and maintenance. Many developments of a material nature were reported in the Badger turbine meters, which range in sizes from 2 in. to 12 in. All changes were made to increase efficiency and serviceability.

Further refinements were included in the disc meters, which range in sizes from ⅝ in. to 6 in., also in the split case type. This centers itself around the standard oil-enclosed gear trains.

The officers of the company reported that the company's engineering staff and research laboratory staff have been added to considerably and have mapped out a definite program of activities which will keep Badger meters abreast of the demands of the field and will introduce such new meters as are necessary from time to time to increase

Representatives of Badger Meter Company, Reading from Left to Right:

1. G. U. Pritchard, Cincinnati, Dist. Mgr.
2. Chas. Reisch, Cincinnati.
3. S. L. D. McClintock, Mattoon, Ill.
4. J. G. Hollowell, Savannah, Ga.
5. B. G. Dow, Elmira, New York.
6. J. C. Miller, Milwaukee, Research Eng.
7. Luke L. Ballard, Gen. Sales Mgr., Milwaukee.
8. E. Krueger, Chief Eng., Milwaukee.
9. H. Buchholz, Asst. Secy.-Treas, Milwaukee.
10. C. W. Wright, Pres., Milwaukee.
11. N. H. Abrams, Waco, Texas.
12. W. J. Zimmers, Director, Milwaukee.
13. J. J. Mueller, Director, Milwaukee.
14. R. M. Stotler, Western Sales Mgr., Kansas City.
15. D. F. Noonan, Eastern Sales Mgr., New York City.
16. J. L. Sinyard, Vice-Pres., Milwaukee.
17. P. Quartana, Time and Cost Dept., Milwaukee.
18. Frank Ketcham, Factory Supt.
19. M. L. Medienka, Kansas City, Mo.
20. W. L. King, Dist. Mgr., Los Angeles.
21. V. C. Perkins, Chicago.
22. E. L. Holzhaueser, Wisconsin.
23. A. C. Hollowell, Charlotte, N. C.

meter efficiency. During the past year the company has successfully developed an automatic batch water meter for accurately measuring water on central concrete mixing plants, also a companion concrete batch mix meter for installation on portable concrete mixers.

During the past year the company's industrial meter division has been expanded and now represents a much greater variety in fluid measuring developments, covering hot water, oil, grease, gasoline, brine and acid meters. An electric alarm register set-up for practical application for measuring equipment as applied to water softeners was also developed.

The company's sales conference was concluded with a banquet at the Milwaukee Athletic Club on the last evening of the meeting. Twenty-five of the company's sales representatives, in addition to district managers and other members of the personnel, attended the meeting. The sales representatives came from all parts of the country, but the attendance was much affected by the influenza epidemic which swept the country at the time this meeting was held.

Modern Plumbing in Land of King Zog

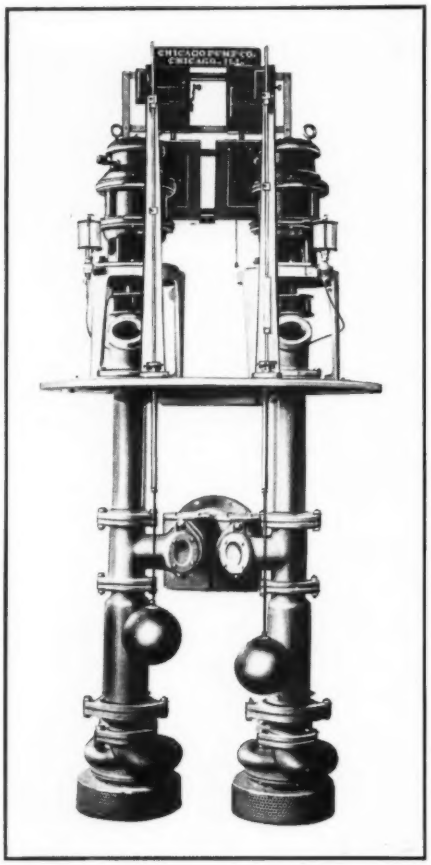
This is a story of Tirana, the home of King Zog of Albania, and it seems as if it ought to begin "Once upon a time," but if it did it would be a fairy story, and this is a true story and the time is NOW 1929.

Tirana is located just northwest of Greece, and King Zog is the newest ruler in Europe, and being a modern king, he wanted some modern improvements, so last month Tirana was supplied with electric lights for the first time in its history.

In spite of the new and modern king and the new and modern electric lights, Tirana is still something of a fairy story appearing town, for the streets are unpaved and there are no sidewalks. On both sides of the narrow main thoroughfare oriental bazaars display their wares—merchandise of all kinds.

There are no "Stop and Go" signals in this town and donkeys laden with wares and women carrying bottles of water on their heads jostle one another in the streets, and to the stronger belongs the right-of-way.

Here then in this town with the fairy-story sounding name and its medieval setting has appeared one of the very latest types of sewage ejectors known to civilization. As soon as the power necessary for operation was available this modern plumbing installation was selected by the American Legation at Tirana.



"Flush-Kleen" product of Chicago Pump Company, chosen by American Legation for installation at Tirana, Albania

Because of the scarcity of mechanics who are familiar with this type of equipment and because repair parts, if needed, would be hard to get, the engineers working for the American Legation gave heed to these matters, and for this reason the manufacturers of the "Flush-Kleen" Sewage Ejectors are pleased that this type of equipment was chosen for the work.

So the "Flush-Kleen" Ejectors have gone to work in the land of King Zog, and it probably won't be long now before the natives and the modern king take up the cry of "Bigger and Better Tirana" and Tirana storekeepers will have to move to other quarters to make way for the steam roller.

Promotions

The Lincoln Electric Company, Cleveland, Ohio, announces that Mr. J. E. Durstine has been advanced to district sales representative for the Southeast, with headquarters at Birmingham, Alabama. Mr. H. P. Egan has been made district sales representative for central Ohio. He will be located at Columbus.

The Lincoln Electric Company are manufacturers of Stable-Arc Welders and Linc-Weld Motors.

To Develop Water Systems on Guaranteed Basis

The Fairbanks-Morse Water Supply Co., Chicago, Ill., has been organized recently to handle the complete development of water supplies on a basis of guaranteed quality, quantity and cost. The parent organization, Fairbanks, Morse & Co., has, of course, been a builder of pumps for many years and has during that time supplied pumps for many of the large municipal and industrial plants of the country. The new subsidiary organization, however, approaches the water supply from an entirely different angle.

After a thorough geological survey and hydraulic investigation of a plant's water supply has shown favorable possibilities, the Fairbanks-Morse Water Supply Co. agrees to deliver a definite quantity and quality of water at a definite price per 1,000 gal. The plan is worked out so that the municipality is not required to invest any money in the pumping plant. Water may be purchased at a fixed price for a period of years, at the end of which time complete title to the plant passes to the city. At any time during the period the municipality has the option of taking over the plant.

Several installations of this character are now being developed. One of these is that of the City of Havre, Mont., where a supply of 3,000,000 gal. a day was guaranteed at an investment cost of $72,000. Three plants are being developed for the city of Brooklyn, N. Y., which will be used for furnishing water for sluicing ashes at incinerator plants. At Muskegon Heights, Mich., another guaranteed supply is being developed.

The Fairbanks-Morse Water Supply Co. is headed by P. D. Bowler as vice-president and general manager. Mr. Bowler was one of the founders of Layne & Bowler Corp. and was president and general manager of that organization for many years.

P. D. Bowler

The Hooker Chemical Plant at Tacoma Begins Operations

THE Hooker Electrochemical Co. of Tacoma, Wash., and Niagara Falls, N. Y., has just completed and put into operation its plant at Tacoma Tide Flats, construction of which was started last August. This is a record in construction of this type. The cut taken from a drawing of McKim, Mead and White, architects, shows the building to be of a permanent character and pleasing in appearance. The site comprises about twenty acres, located on Alexander Avenue near Hylebos Waterway. In choosing this site the officers of the company secured convenient shipping facilities, satisfactory power supply and rates, without excessive land values. These features allow a central distributing point for liquid chlorine and a convenient foreign outlet for caustic soda.

The twenty-five years of experience gained by the Hooker Company in their Niagara Falls plant, which was started on a small scale and is now one of the largest chlorine producers in the country, has enabled them to open the Tacoma plant on a large scale. With the exception of a few skilled executives transferred from the eastern plant, the personnel of the western organization is made up of western men.

The patents covering the Townsend Cell (the process of manufacture whereby electric current is passed through a brine solution made from common salt, thus securing the elements sodium and chlorine), are owned by the company. This process is economical in power consumption and requires a minimum floor space per ton of output, in that Townsend Cells can be efficiently run at over 5,000 amperes. About twenty different chlorine products are now being manufactured at the Niagara Falls Plant, and these products will be duplicated in the west as the demand arises.

Elon H. Hooker, President of Hooker Electrochemical Company

Tacoma Plant of Hooker Electrochemical Company from drawing by McKim, Mead & White, Architects

The two main raw materials for this plant are power and salt. The power is supplied under a contract with the Department of Public Utilities of the City of Tacoma, and the salt is secured in New York, Louisiana, California and from Spain, Italy and China. Handling facilities permit of it being unloaded at a rate of 1,000 tons a day, and it is stored in steel tanks to provide for full capacity operation for many months.

The general supervision of the sales work of the company is in the hands of Mr. M. H. Hooker, one of the three vice-presidents, while Mr. A. H. Hooker, Jr., is sales manager for the Tacoma plant. Mr. Hooker, Jr., has his headquarters in Tacoma and is available at all times for consultation on sales service problems.

The general administrative offices of the company are located at 25 Pine Street, New York City, in a building owned by the company, and in this building Mr. Elon H. Hooker, president of the company, has his offices. Mr. Willard Hooker and Mr. E. R. Bartlett serve the company as vice-presidents, and Mr. Bartlett also occupies the position of works manager for the plants at Tacoma and Niagara Falls. Mr. R. L. Murray is superintendent of the plant at Niagara Falls, and Mr. J. A. Flynn fills this office for the Tacoma organization. The other officers are Mr. J. M. Rowland, chief engineer; Mr. A. M. Hooker, technical director, and Mr. L. A. Ward, secretary.

The present capitalization of the company is $2,700,000 6 per cent cumulative preferred stock, par value $100.00, and $2,500,000 common stock, $100.00 par value, paying 6 per cent annual dividends. The bonded indebtedness is approximately $3,500,000, of which $1,500,000 6 per cent service B bonds were recently sold. It is believed that the investment in the Tacoma plant is something in excess of $1,500,000.

Follow Through

The Insley Manufacturing Company, engineers and manufacturers of Indianapolis, Indiana, and a division of the National Equipment Corporation, has issued in booklet form, for the use of their salesmen, all trade paper advertising to be used by them during the first six months of the year. Because it seems such a practical thing to do, we quote the statement which appears on the cover:

"Good advertising is nothing more or less than the assembly in printed form of the sales experience of an organization and the selling points proven to be most effective, to the end that the work of the salesmen in selling the customer is made easier, and the efficiency of the salesman is therefore increased.

"We want our salesmen to know our advertising, and to use it effectively. Each Insley advertisement has, or should have, a separate basic idea or sales appeal, which either advances our products in the esteem of the prospect or meets resistance that may be in his mind. The salesman should know these points, watch for new ones and incorporate them in his sales presentation.

"With this idea in mind we have had proofs of our Trade Paper Advertising for the first six months of 1929 made in booklet form, and request that you put it in your Insley Sales Manual, and refer to it occasionally. We hope it will help you yourself develop new ideas, and that it will help you put these ideas across with your customers. If it does this, it is good advertising."

All distributors will see the logic and good sense in the Insley Manufacturing Company, asking their salesmen to study their national advertising, and the same reasons which make it advantageous to these salesmen, will make it equally valuable for distributors to study the advertising of all the lines which they represent. Insley has presented this method to their men in a very compact and convenient form, but distributors could make their own booklets, containing, just as the one described, all advertising presenting their lines for from three to six months, as the advertisements appear, and study them. Take advantage of the national advertising which the manufacturers give you, and follow through.

Uniform Name Adopted for International Cement Companies

According to a statement issued by Mr. H. Struckmann, president of the International Cement Corporation, all subsidiaries of this corporation in the United States, as well as the Cuban Portland Cement Corporation, Argentine Portland Cement Company and the Uruguay Portland Cement Company, will be known as the Lone Star Cement Company. This change in no way affects the management, policies or products, but is one in name only.

The name, now universally adopted, had its origin about 30 years ago in the "Lone Star State," when a small mill in Texas began to produce Lone Star Cement, and which was to grow into a chain of 13 mills with an annual capacity of 20,000,000 barrels, under the direction of the International Cement Corporation, formed in 1919, when the annual capacity was 2,900,000 barrels.

While each Lone Star Cement Company is an independent organization, the resources of the International Corporation are available for scientific research and support in all modern practices. "Incor," a perfected high-early-strength Portland Cement is one of the achievements of the International System. This product was used in the construction of the Moffat Tunnel, and also in the Arlington Memorial Bridge, over the Potomac River from Washington, D. C., to Virginia, now under construction.

The mills of the Lone Star Companies are located in Alabama, Indiana, Kansas, Missouri, Louisiana, Pennsylvania, Texas, New York and Virginia, as well as the foreign countries previously mentioned. Cooperation between these companies enables them to render rapid, dependable service.

Road Show Queen Rides a Caterpillar

Miss Lily Damita, starring with Ronald Colman in The Rescue and The Bridge at San Luis Rey, who was acclaimed Queen of the Road Show at Cleveland, during her personal appearance in that city. "Good Roads lead to Good Movies," said Miss Damita, "and both are great educators and instruments of peace and understanding." This is the first "Caterpillar" Ten of the line and already famous as the most traveled and viewed tractor in the world. It has traveled over 10,000 miles and has been seen by over 1,000,000 people. Gov. C. C. Young's daughter unveiled it at California State Fair. "Jimmy" Walker unveiled it at Eastern States Exposition.

Gorman Joins Wallace & Tiernan

Arthur E. Gorman, well known sanitary engineer, has joined the staff of Wallace & Tiernan, and will be located at the headquarters of this company in Newark, N. J., on sales promotion work. Mr. Gorman has served the Department of Public Works of the city of Chicago as chief sanitary engineer, and more recently as public health engineer for the Sanitary District of Chicago.

He entered the service of the city of Chicago in January, 1924, following the water-borne typhoid fever outbreak on the South Side in the fall of 1923, prior to which time he served for six and a half years with the United States Public Health Service as an assistant and associate sanitary engineer. A very effective system for supervision and control over the chlorination of Chicago's water supply was installed under his direction.

The American Water Works Association, in June, 1927, awarded to him the John M. Diven Memorial Medal, as the member "who has best served the Association during the year." For two and a half years he served the American Public Health Association as secretary, and last year was made chairman of the Public Health Engineering Section of this association. When the American Water Works Association met in Chicago in 1927 he was secretary of the Chicago Local Committee, and last fall at the Fifty-seventh Annual Meeting of the American Public Health Association in Chicago, he served as Convention Manager.

Mr. Gorman has a wide acquaintance in the waterworks and public health profession and has the best wishes of his friends in his new undertaking.

Cutler-Hammer, Inc.

According to a recent announcement the Cutler-Hammer Manufacturing Company of Milwaukee, Wisconsin, has become Cutler-Hammer, Inc. The new company is organized as a Delaware corporation with the following officers: Chairman of the Board, R. F. Bacon; President, B. L. Worder; Vice-president, F. L. Pierce; Vice-president, J. C. Wilson; Treasurer, H. F. Vogt; Secretary, W. C. Stevens.

The Board of Directors announced are: F. R. Bacon, Milwaukee, Wis.; F. L. Pierce, Milwaukee, Wis.; B. L. Worden, West Orange, N. J.; Carl A. Johnson, Madison, Wis.; T. Johnson Ward, New York, and L. A. Lecher, Milwaukee.

In the change from a Wisconsin to a Delaware corporation the Cutler-Hammer Mfg. Co., of Milwaukee, the Cream City Foundry Co., of Milwaukee and Cutler-Hammer Manufacturing Co., of New York, are united under one name. They are identified with the manufacture of electric motor control, wiring devices and allied lines.

Timken Steel & Tube Co. Plans $1,000,000 Expenditure

A 200-acre tract of land, extending 2 miles west of this company's present holdings, has been purchased to put into effect during the coming year an expansion program which will amount to about $1,000,000. Room will be provided for future expansion, according to information received from the Timken Roller Bearing Company, of Canton, Ohio.

A tube mill, the first unit of this work, is now under way. This calls for a building 320 feet wide by 420 feet long, which will represent for building and equipment a cost of about half a million dollars. It is expected that this mill will be ready for operation by April 1st.

Palouse Tractor and Equipment Co. Takes Western Territory

According to newspaper story, the subdivision of the territory formerly served by the Hofius-Ferris Company in the far west, a new company has been organized to take over Whitman County, Washington, and Clearwater and Latah counties in Idaho, as tractor and equipment distributing headquarters. The new company will incorporate for $50,000 and operate under the name of The Palouse Tractor and Equipment Company.

H. W. Fairweather and L. J. Acuff, former residents of Spokane, become managers of the new company and will reside in Pullman, Washington. They were formerly interested in the Hofius-Ferris Company. Mr. L. C. Thomas, who had been serving as manager of the Pullman branch of Hofius-Ferris, will also be connected with the new organization.

Hercules Motors Declares Dividend

The year 1928 paid a total dividend of $5.00 to the stockholders of the Hercules Motors Corporation of Canton, Ohio, according to a report of a meeting of the directors held the last of December. A $2.50 dividend was declared July 1st, and the same amount January 2, 1929.

Business for the past year was reported as slightly in excess of 50 per cent over the previous year, and profits increased accordingly. Orders on the company's books for delivery during 1929 are already in excess of the total number of units shipped during 1928, and the increase of 1929 over the business of 1928 promises to be a large one, judging from present reports.

The following directors and officers were elected: H. H. Timken, Chairman of the Board; E. A. Langenbach, president; Chas. Balough, vice-president and general manager and H. P. Blake, Secretary. H. H. Timken, E. A. Langenbach, R. W. Gallagher, Gordon Mather and Chas. Balough will succeed themselves as directors.

H. Burdett Cleveland Announces New Member of Staff

Mr. Arthur L. Reeder, a member of the Society of Civil Engineers, and of the American Water Works Association has recently joined the staff of H. Burdett Cleveland, Consulting Sanitary Engineer, as Principal Assistant Engineer.

Mr. Reeder's experience in water purification and sewage disposal and construction, has been extensive. Over a long period of time he was connected with the Philadelphia Filtration Bureau, the Baltimore City Water Department and with the Pennsylvania State Department of Health. His most recent work has been in connection with installations at Reading, Pa., and Youngstown and Niles, Ohio.

The offices of these consultants are located at 225 Broadway, New York City.

Prest-O-Lite Establishes New Plant at Memphis

A new Prest-O-Lite Acetylene Plant, at 1241 North McLean Boulevard, Memphis, Tenn., commenced operations December 19, 1928. This plant, which is the thirty-sixth of the Prest-O-Lite chain, will supply nearby industries with dissolved acetylene for oxy-acetylene welding and cutting.

J. Brown is superintendent of the Memphis plant and C. A. Anderson, whose headquarters are at Birmingham, is district superintendent.

A. J. Sweet Joins Westinghouse

Mr. Arthur J. Sweet, formerly in consulting practice in Milwaukee, has joined the Commercial Engineering Department of the Westinghouse Lamp Company. Since 1910, when associated with the Holophane Company, Mr. Sweet has made extensive studies of street lighting problems.

In 1913 Mr. Sweet went to Milwaukee to become a member of the firm of Vaughn, Meyer & Sweet, and while serving in this capacity the City of Milwaukee adopted the recommendations of his firm for a complete new street lighting system. After severing his connection with this firm he entered into independent practice, which he continued until joining the Westinghouse organization.

Monarch Tractors Corporation Becomes Division of Allis-Chalmers Mfg. Co.

An announcement from the Allis-Chalmers Manufacturing Company, Milwaukee, states that the Monarch Tractors Corporation is to be taken over and operated as the Monarch Tractors Division, Springfield Works of Allis-Chalmers Manufacturing Company, effective January 1st, 1929.

The Springfield, Illinois, works will continue the manufacture and distribution of the Monarch Tractors, but will have the advantage of the larger organization and increased facilities gained through the new arrangement.

Change of Address

Announcement is made of the removal of the California Filter Company to their new headquarters, 981 Folsom Street, San Francisco, Calif.

Representatives or New Lines Wanted

Editor's Note.—From time to time we receive letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment, or from manufacturers seeking representatives for their products. Items of this kind will be published and names and addresses furnished interested persons upon request.

New York corporation wishes to establish agencies throughout the country, prefer men specializing in heating and ventilating equipment.

A manufacturer of paving expansion joints is looking for distributors for northern California territory.

New York corporation, producing complete line of coal-tar products, wishes to make dealer connections throughout the country.

A contractor's superintendent, located in Florida, would like to represent some road equipment manufacturers in his territory.

A Michigan distributor, with many years' experience, representing at this time prominent manufacturers of pumping machinery, offers the services of an established representative to manufacturers needing increased facilities in this region.

Manufacturers' representatives located in New York would like to add line of heavy contractors' equipment of established reputation, other than the lines now handled by them. They would like exclusive sales rights for such equipment.

New York company would like to represent manufacturers not already established in eastern market, or who would like to make a change in their sales arrangements.

Machinery company in the east is interested in representing established lines of road machinery, with the exception of graders.

A man of many years' experience in the machinery business in the south would like to make a business connection for the sale of road machinery equipment.

Eastern Distributor handling Brick and Clay Products, and similar commodities, would be pleased to get in touch with manufacturers desiring eastern representation.

The Third Conference of the Machinery and Equipment Association is scheduled to be held at the United States Chamber of Commerce Building, February 14th.

Link-Belt Announces Three More West Coast Appointments

LAST August the Pacific Coast Division of the Link-Belt Crane and Shovel Department was opened in San Francisco by the Link-Belt Company, whose executive offices are located in Chicago. R. B. ("Buckets") Randall was made manager of this division, and Garfield & Company became agents for northern California and Nevada. At that time it was announced that several other appointments in the western terriory would follow.

In September A. H. Cox & Co., Seattle, was appointed as agent for Washington, and the National Machinery Co., Vancouver, for British Columbia. Now the announcement is made that J. L. Latture Equipment Company, Portland, has become Link-Belt crane and shovel agent for the state of Oregon and eastern Washington.

The National Machinery Company is

A. H. Cox, President

eminently fitted for handling British Columbia territory, and is ably headed by Mr. Newson as manager. All of the organizations named are well known throughout the northwest, and in addition to the Link-Belt account, they are representatives for several other leading manufacturers.

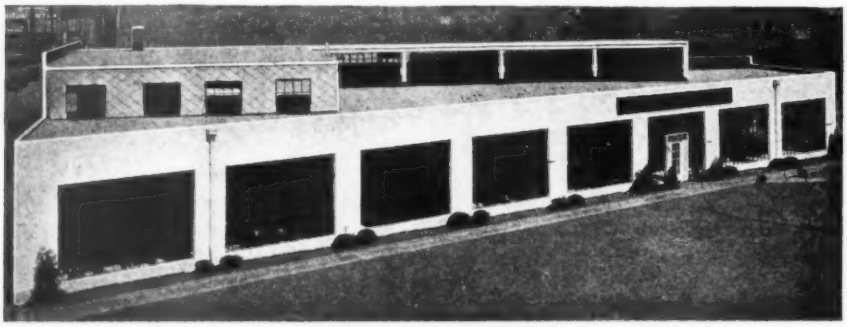
A. H. Cox & Company organized in 1910 to do a general machinery business, and in 1919 expanded and entered the construction equipment field. A. H. Cox, president, G. H. Jamison, manager of the construction equipment department, and W. F. ("Duggan") Lewis, formerly with Link-Belt Meese & Gottfried Company, are widely known in the crane and shovel industry.

The J. L. Latture Equipment Company was established in 1919. It now occupies a four-story concrete building which houses offices, display sales rooms

J. L. Latture, President

and warehouses. The president of this organization, J. L. Latture, enjoys a wide acquaintance among members of the contracting and logging industries of the northwest. The views we present with this story give a very good idea of the type of men and plants caring for the equipment machinery distribution in the far west.

The Link-Belt line of cranes and shovels, which has been supplemented by



A. H. Cox & Co., Seattle

J. L. Latture Equipment Co., Portland, Ore.

two new models within the past year, covers a range of sizes from ¾-yd. to 2 yd., each equipped and easily convertible as shovel, crane, dragline, trench shovel and skimmer excavator.

Day & Maddock to Represent Erie Machine Shops

Announcement has been made of the appointment of Day & Maddock as distributors for the eastern Ohio territory for the Erie Machine Shops of Erie, Pa., manufacturers of Erie Steam and Gasoline Rollers. They will be located at West 82nd Street, south of Dennison, Cleveland, Ohio.

Linde Air Products Opens New Memphis Plant

A new oxygen producing plant was put into operation by The Linde Air Products Co., of New York, at Memphis, Tennessee, late in December. The new plant is located at 1241 North McLean Boulevard, with Mr. E. C. Heyman, superintendent of the old plant, in charge. The old plant, at 48 West McLemore Avenue, has been discontinued.

New Appointments

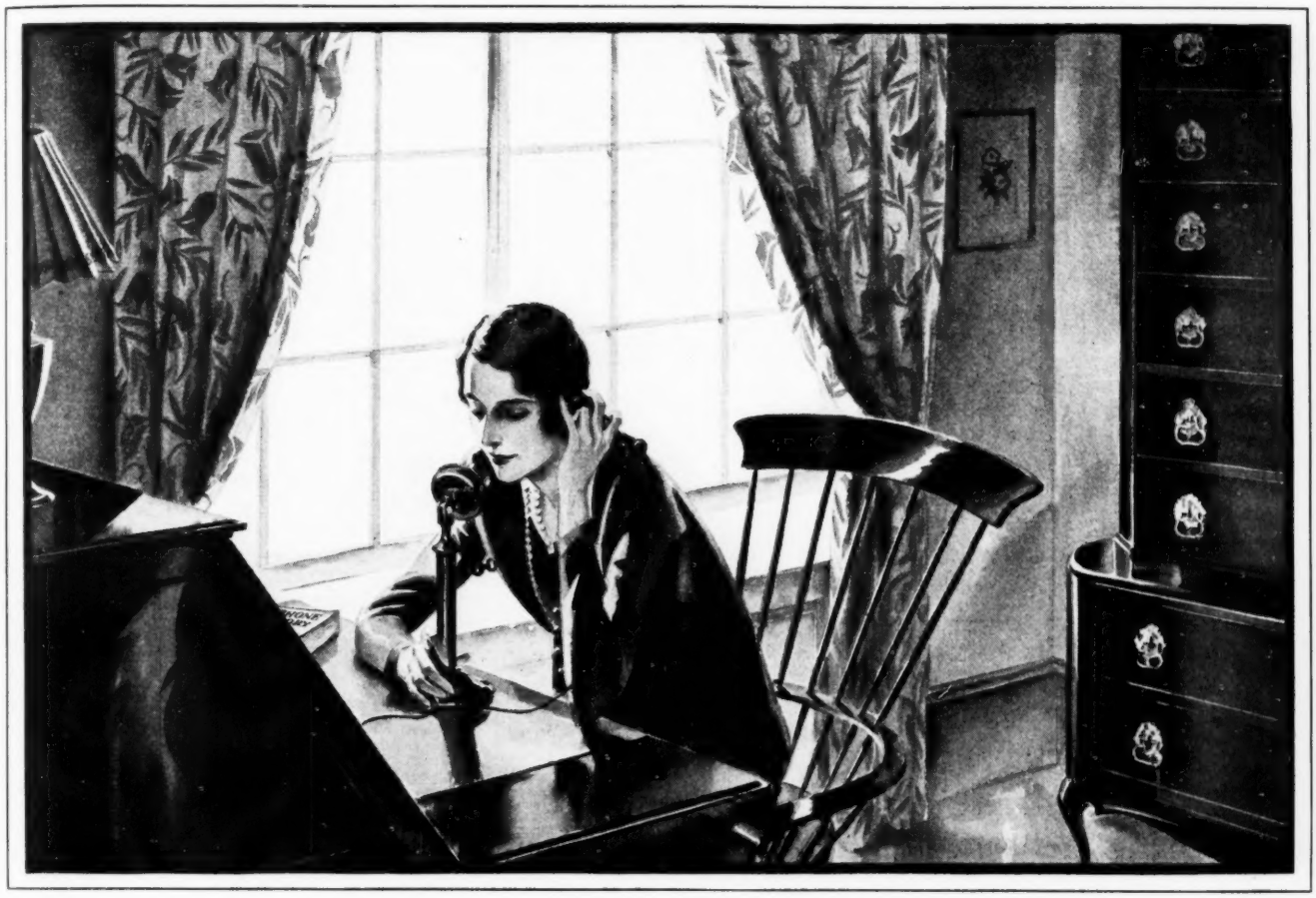
The Chicago Pump Company announces that the following representatives will handle their products during the coming year:

Ace Combustion & Engr. Co., 222 Milan St., Shreveport, La.; Harry Cooper Supply Co., 1224 Chemical Building, St. Louis, Mo.; F. L. Bunker, P. O. Box 1223, Greenboro, N. C.; L. Brandenberger, 149 W. 2nd St., So., Salt Lake City, Utah; Alfred P. Brown, Dexter Horton Bldg., Seattle, Wash.; John A. Butler, 18 Catherine St., Lynbrook, L. I.; Robert B. Brown, Newark, N. J.; J. J. Smith, 3620 Ednor Road, Baltimore, Md.

A Change of Address

The Southern Iron & Equipment Co., rebuilders of locomotives, cars, shovels, etc., who for the past twenty years have had their offices in the Grant Bldg. at Atlanta, Ga., have moved their general offices from the Grant Bldg. to their works at Hemphill Ave. and Southern Railway, Atlanta.

(Continued on page 40)



There is no standing still . . .

An Advertisement of the
American Telephone and Telegraph Company

DURING the past two years 6000 switchboards have been reconstructed in the larger cities served by the Bell System to enable the operators to give a more direct and faster service.

Previously in towns where there were more than one central office, your operator would hold you on the line while she got the operator at the other central office on an auxiliary pair of wires. Now she connects directly with the other central office and repeats the number you want to the other operator. You hear her do this so that you can correct her if there is any mistake.

This little change cost millions of dollars. Likewise, it saves millions of minutes a day for the public and it has cut down the number of errors by a third.

It is one of the many improvements in methods and appliances which are constantly being introduced to give direct, high-speed telephone service.

There is no standing still in the Bell System. Better and better telephone service at the lowest cost is the goal. Present improvements constantly going into effect are but the foundation for the greater service of the future.

"THE TELEPHONE BOOKS ARE THE DIRECTORY OF THE NATION"

Municipal Officials
Contractors
Engineers

Valuable Information Yours for the Asking

Write Now

Catalog Service

Useful Equipment Information

Watch these trade announcements for new and improved equipment

By writing the manufacturers named and mentioning this magazine, copies of the following catalogs will be sent to you without obligation

TRADE PUBLICATIONS

Pavement Breakers, Drills, Compressors.—Several new pieces of literature have just been issued by the Sullivan Machinery Co., 122 South Michigan Ave., Chicago, copies of which will be sent upon request. Bulletin No. 81-V describes and illustrates the new K-2 Buster, for breaking concrete. This tool provides a wide degree of utility with economy in operation. Bulletin No. 81-S contains 32 pages and is devoted to rock drills. Full description and illustrations are given of model L-7 Rotator Rock Drill, steam rotator, DP-331 and light rotator, DP-321. Both of these bulletins are on heavy enamel paper in the loose leaf style, suitable for filing with other literature. Booklet No. 2007 is an attractive broadside illustrating portable compressors (which are given more in detail in Catalog 83-F), Drills, Spaders (Catalog 81-N), Portable Hoists, and Drill Sharpeners (new Catalog 72-I). If asking for any of this literature, we would appreciate it if you would give the name of our publication.

Hydrants, Valves, Etc.—Write to the Columbian Iron Works, Chattanooga, Tenn., for descriptive literature of the Columbian Fire hydrants, Gate valves, Valve boxes, Hydrant extension sections, or other water works equipment. We would appreciate it if you would mention our publication if asking for information.

Cast Iron Pipe.—United States Cast Iron Pipe & Foundry Co., Burlington, N. J., will be pleased to send you literature explaining the differences between the deLavaud Cast Iron Pipe and other types of pipe. This is a centrifugally cast pipe in which the graphite particles are finely divided and evenly spread.

Traffic Treads.—Alan Wood Iron & Steel Company, Widener Building, Philadelphia, Pa., have issued a new catalog illustrating and describing their "AW" Diamond Pattern Rolled Steel Traffic Treads and will be pleased to send copy upon request. These treads will be found of interest to highway officials and engineers who are put to it to prolong the life of wooden floor bridges and enable them to stand the wear and tear of modern traffic. On new bridges a traffic lane is determined upon and the treads laid accordingly, or are laid over the lines of traffic wear on old and worn floors. This company has branch offices in Boston and New York in the east, Dallas in the southwest and Seattle, San Francisco and Los Angeles in the west. Write to any of their headquarters for full particulars concerning this product. Kindly mention our magazine if writing for a catalog.

Tractors.—Caterpillar Tractor Company of San Leandro, Calif., and Peoria, Ill., has just issued a new 32-page booklet giving specifications and construction details of the new "Caterpillar" Ten. The track assembly with all its parts, the transmission, steering clutches, brakes, drive, and engine construction are thoroughly discussed. A complete list of specifications and special equipment is included. Copies of this book may be secured from the local dealers, or by writing the manufacturer. If requesting a copy of this book, kindly mention our publication.

Paver.—The Ransome Concrete Machinery Company of Dunellen, N. J., has just issued a very handsome, fully illustrated 36-page book, called "The Master Paver." A complete description is given of the Power Loader, Water Control, Drum, Drum Rollers, Discharge, Boom, Boom Bucket, Supporting Frame, Operating Levers, Engine, Gears, Shafts, Clutches, Main Frame, Crawler, Crawler Drive, Derrick, Distributing Chute and Calcium Chloride Attachment. Important parts are clearly shown in photographs, and pictures of the paver at work on specific jobs are shown, and names of the owners given. The book contains diagrams and specifications of the new Ransome 27-E, and one section is devoted to "Central Mixing Plants." If writing the manufacturer for a copy of this book, kindly give the name of our publication.

Pipe Cutting Tool.—A folder from the Tucker Company, Inc., 75 Murray Street, New York City, gives a detailed description and price list of parts in all sizes of their cutter for cast iron pipe. This tool can be used in any ordinary trench without extra excavating. It will cut a piece one inch long or more at any point without starting joints or otherwise disturbing the main, and will make a clean cut in a gas or water main in the trench. Write to the Tucker Company for literature and price list of the Anderson Pipe Cutting Tool. In writing, kindly give the name of our magazine.

Water Level Indicators — Weather Gages, Etc.—Several pamphlets have been received from Julien P. Friez & Sons, Baltimore, Maryland, devoted to their recorders, indicators and air gages. In the Airport Bulletin two outfits are described. For large airports a complete set of instruments for observing meteorological conditions is offered. In addition to permitting visual observation of all local weather conditions, this equipment records these conditions graphically on charts. A complete picture of the weather is thus furnished. Equipment No. 2 is an economical combination of instruments for airports when complete meteorological records are not desired. The Bulletin "Telaugage" describes the Au Water Level Indicator for remote indications of levels of all impounded and flowing waters. The development of the self-synchronizing electric motor has made possible the accurate transmission of this information automatically and its reproduction, several miles away if necessary, on dials graduated to show changes as small as one-hundredth of a foot. For literature on these Recorders, Indicators and Airport instruments write Julien P. Friez & Sons, Baltimore, Md., mention our publication.

Electrical Testing. — The Wagner Electric Corporation of St. Louis, Missouri, has just issued the fourth edition of its bulletin on Manual of Electrical Testing, a 20-page bulletin on testing single phase and polyphase motors, and testing transformers for core loss, copper loss, polarity, insulation, temperature rise and efficiency. This is a loose leaf style bulletin suitable for binding with other literature. The bulletin gives the addresses of the offices of this corporation located in all the principal cities from coast to coast. If writing for a copy of this particular bulletin specify No. 138. We would appreciate it if you would give the name of our magazine.

Municipal Refuse Incinerators.—The Hiler Engineering & Construction Co., Inc., 122 Livingston Street, Brooklyn, N. Y., has issued a very attractive little 24-page booklet on the Heenan System of Municipal Refuse Incinerators. This system of municipal waste disposal was made the recognized standard in the United States in 1906 after one of the most exhaustive studies of the problem had been made, covering existing plants in this country and abroad. Illustrations and descriptions are given of the plants in use in the

(Continued on page 42)

U. S. GOV'T. WATER CARTS At a Give-away Price

Cost U. S. Gov't. $275.00 Each

ONLY

$37.50

F. O. B. Columbus, Ohio

Horse Drawn

Shipping Weight 1600 Lbs., Crated

SHIPPED DIRECT From Government Warehouse

A Cart With Many Uses

These Water or Tank Carts are part of the U. S. Gov't surplus stock—they are brand new, have never been used—cost $275.00 each and we now offer them to you at the almost give-away price of only $37.50.

Think of it!—a 150 Gallon, Heavy Gauge Galvanized Iron Tank Cart, equipped with Double Acting Gould Force Pump—25 ft. of 2" hose—16 Brass Faucets, etc. Strong, Sturdy 54" Wheels, Steel Hubs and Axle—for less than 1/6 what the Government originally paid for them!

These Carts are horse drawn—and make the ideal equipment for sprinkling walks or roadways—for sprinkling and spraying flowers, trees and shrubbery—for hauling water, gasoline or oil—a real handy utility Tank Cart with dozens of uses.

Send us check or money order for $37.50 and we will send you one of these Water Carts, in its original crate, just as it was delivered to the U. S. Gov't by the Studebaker Wagon Works or other high grade manufacturer who built it.

Note These FEATURES

Made for the U. S. Gov't by the Studebaker Wagon Works and other high grade Wagon Builders. Never used—comes to you in original crates just as delivered to the U. S. Gov't Warehouse. A mighty useful and handy outfit. Tank is of heavy gauge one-piece galvanized iron, with splash partitions, solid riveted joints, capacity 150 gallons, Gould Double Acting Force Pump, extra large strainer—25 ft. of 2-inch hose (we do not guarantee condition of hose, yet it may give considerable service); wheels 54 inches in diameter, 3-inch steel tires, 10-inch steel hubs; tread 56 inch, steel axle 2x2 in.; foot brakes, tool box under seat; 15 brass faucets in rear for drawing off contents and one extra large master faucet.

For Spraying

Easily converted into a sprayer. By making a few changes in the pipe connection, this outfit can be converted into an air pressure sprayer worth at least $300.00. Instructions sent with each cart.

Guaranteed Exactly as Represented

You take absolutely no risk in ordering these carts. The publishers of this paper have inspected these Carts and know the splendid value represented in these carts and the opportunity for its subscribers to get the greatest Bargain ever offered. Remember, these carts have never been used—come to you just as delivered to U. S. Government. They are EASILY WORTH SIX TIMES THE PRICE WE ASK.

We can't begin to tell you in this ad the wonderful value represented in these Tank Carts—they must be seen to be appreciated. We do know that after you get one, you wouldn't sell it for several times the low price you paid for it. Many who have ordered one, after receiving it and seeing its splendid value and the many uses to which it could be put, have immediately ordered from one to three more. Send your order now.

National Jobbing & Export Co. Dept. Z, 192 N. Clark St. Chicago, Illinois

principal cities. At Buffalo, N. Y., is the largest incinerator plant in this country which represents the latest type of the Heenan System and which has the most complete and effective equipment for the handling and destroying of 500 tons of Mixed Garbage and Rubbish in 24 hours. Write for literature on this system.

Western Hot Patch Plant.—A product of the Austin-Western Road Machinery Company, 400 North Michigan Avenue, Chicago, for keeping roads in repair winter and summer. Write to their Chicago office or any branch office for their Bulletin on Winter Repair Work for particulars concerning this equipment. We would appreciate it if you would mention our magazine.

Cast Iron Pipe.—The McWane Cast Iron Pipe Company of Birmingham, Alabama, will be pleased to send upon request, illustrated literature giving full information concerning their product, its cost, life and uses. The western branch of this organization is the Pacific States Cast Iron Pipe Company of Provo, Utah.

Aerator.—The Simplex Surface Aerator, an effective means of producing "activated Sludge," is fully described in Bulletin E-5-28, issued by the Simplex Ejector and Aerator Corporation. The Chicago address is 2528 W. Madison St., Chicago. If writing for literature, kindly mention our magazine.

Automatic Air-Lift. — The Sullivan Machinery Company, 130 South Michigan Avenue, Chicago, has a handbook on their automatic air lift, and special automatic control information of particular interest to water works superintendents. Their catalogs also describe air made wells, and contain a complete story of how a city elected a mayor on his promise to get them well water, and how his promise was kept by the use of this method. Kindly mention our publication when requesting catalogs.

Layne Well Systems. — Write to Layne & Bowler, Inc., Memphis, Tenn., for information concerning their guaranteed pumps and screens. We would appreciate if it you would use the name of our paper if writing for particulars.

Wrought Iron Pipe.—"The Installation Cost of Pipe" is the title of a Bulletin issued by the A. M. Byers Company, Pittsburgh, Pa., containing cost data and full particulars concerning this product and its uses. Ask for Bulletin No. 38, giving the name of our magazine.

Trimo.—The trade name by which the wrenches manufactured by the Tremont Manufacturing Company, Inc., are known. These pipe wrenches are made with a braced frame to stand the hardest strain, with hard biting jaws that can be easily renewed, and the heat treated steel handles assure tremendous strength. Write for detailed information and prices to Roxbury (Boston), Mass., mentioning the name of this magazine.

Gate Valves.—The Darling Valve & Mfg. Company, with offices in New York, Chicago, Houston and Oklahoma City and headquarters in Williamsport, Pa., will be pleased to send you literature on the construction and operation of the Darling Gate Valves. If writing for particulars on this product, kindly mention our paper.

Deep Well Works.—The United Iron Works, Inc., of Springfield, Mo., with general offices in Kansas City, manufacturers of "Pomona" double stroke deep well power pumps, offer without obligation methods for economically solving pumping problems. The engineering experts will be pleased to advise with you. Descriptive catalogs will be sent upon request. If writing, kindly give the name of our magazine.

Pumps. — New Catalog containing complete information on centrifugal pumps, plunger pumps, and deep well power heads may now be obtained by writing the American Well Works, Aurora, Illinois. Their engineering department will be pleased to discuss your needs with you, recommending the best equipment for your purposes. Kindly use the name of our publication if writing for information.

Mono-Cast Pipe. — The trademark name of the American Cast Iron Pipe Company for a centrifugal cast iron pipe made in a refractory mold, was chosen because only one second is required to transform the molten metal into pipe by this method. Write to the Birmingham office of this company, or to their branches in the principal cities for literature on this product. Ask for information on Mono-Cast Cast Iron Pipe, giving the name of our magazine.

Disposal Plants. — Fairbanks-Morse and Co., Chicago, or any of their branch offices in the principal cities will be pleased to furnish complete details concerning their F-M Trash pumps for handling unscreened sewage direct from sewers. Write for information, giving the name of our publication.

Excavators.—Write to the Bucyrus-Erie Company at Erie, Pa., or to their branches in any of the principal cities for information concerning the performance of their excavating machines. This will give you a gauge by which to measure the work you are now able to do, with the records of other equipment.

Ejectors.—The Shone Sewage Ejectors, manufactured by Yeomans Brothers, 1423 Dayton Street, Chicago, are in use in all quarters of the globe with long service records to their credit. Write to this company for literature giving the special features which enter into the merits of this equipment.

Cast Iron Pipe.—"The Two-Main System" is the title of a book which The Cast Iron Pipe Research Association is distributing free to city officials, engineers and taxpayers. It is a pocket size volume, written in non-technical style, with charts, drawings and photographs to make the telling more forceful. It explains how the two-main system is able to meet the demand of the taxpayer for a means of preventing the tearing up of costly streets for extensions, repairs, etc. A valuable book for public officials and engineers. Write to Mr. Thos. F. Wolfe, Research Engineer, Peoples Gas Bldg., The Cast Iron Pipe Research Association, for a copy of this book, kindly mentioning the name of our paper.

Clay Pipe.—The Clay Products Association, Conway Building, Chicago, makers of vitrified clay pipe, will be pleased to send you full information regarding this product.

Meters — Gauges — Valves. — Information on complete equipment for filtration plants may be secured by writing the Simplex Valve & Meter Company, 6749 Upland Street, Philadelphia, Pa. The Simplex Rate of Flow Controller is adaptable to large and small filter plants from 30-inch effuent to 3-inch. The Simplex Venture Type Meter indicates, records and totalizes the rate of flow, and the Simplex Filter Gauges may be had in many combinations of Indicating, Recording and Totalizing. If writing for particulars on this equipment, kindly mention our magazine.

Filtration Plants.—Norwood Engineering Company, Florence, Mass., will be pleased to send you full particulars regarding the Norwood Municipal Filtration Plants. Kindly give the name of our publication if requesting information.

Steel Tanks.—A new Water Works Catalog has been issued by the Pittsburgh-Des Moines Steel Company, 906 Tuttle St., Des Moines, and 4 Neville Island, Pittsburgh, Pa., with branches in the principal cities. These elevated steel tanks insure a large supply of water at any and all times. If desiring information, ask for Catalog No. 2, kindly giving the name of our magazine.

Pipe Cutter.—Manufactured in two sizes for all types of pipe by the Ellis & Ford Mfg. Co., 18 Piquette Ave., Detroit, Mich. Circular giving full particulars will be sent by manufacturer upon request. We would appreciate it if you would mention our magazine, if writing.

Meter Boxes.—The Ford Meter Box Company of Wabash, Indiana, have a special bulletin on the Ford Type S Meter Boxes for "warmer climates." Meters can be set or removed in an instant. The Ford standard testers can be adapted for testing meters in a series, each meter clamped in separately and the work economically and conveniently handled.

Centrifugal Pumps. — Catalog-W-67

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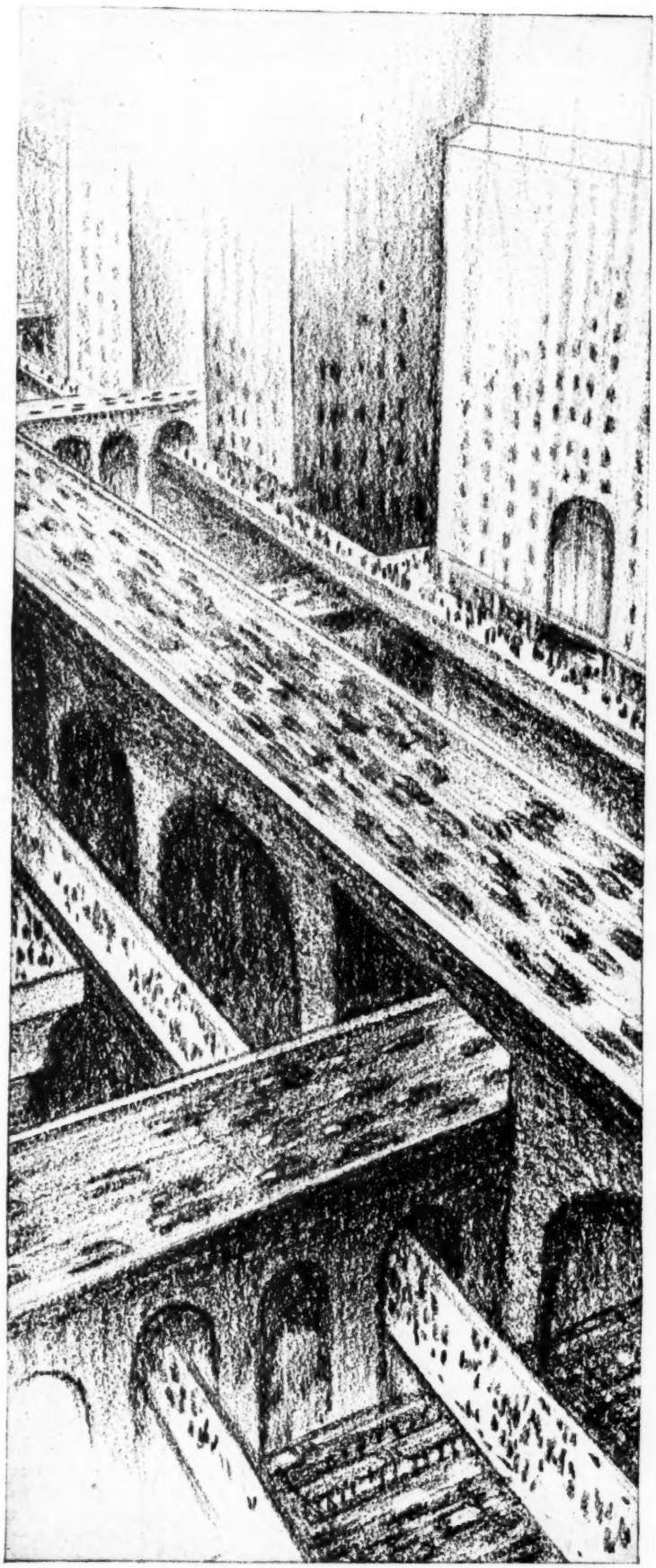

FOR CITIES WHICH LOOK 100 YEARS AHEAD

CITIES looking a century ahead are planning to meet problems undreamed of a decade ago. Problems involving underground and surface transportation . . . . pedestrian and motor traffic . . . . the interlocking problem of proper gas and water systems.

The streets of the future need never be torn up for pipe replacements. For cast iron pipe may be laid and forgotten. Cast Iron pipe's full span of life has never been measured. Mains that have served a century, two centuries, and longer, are still in service.

Cast Iron Pipe made by the members of The Cast Iron Pipe Research Association is manufactured under laboratory control to the modern standards of the Association members. The Association offers to taxpayers, city officials and engineers, information on every subject pertaining to the use of pipe for water, gas, sewers, road culverts and for industrial needs. All information is supplied without cost or obligation. Address: Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago.

CAST IRON PIPE

issued by DeLaval Steam Turbine Co., Trenton, N. J., gives methods of meeting water supply problems at the lowest cost. Full information regarding geared steam turbine driven pumps, electric motor driven pumps or internal combustion engine driven pumps. If writing for a copy of this booklet, kindly give the name of our publication.

Hydraulic Supplies.—Write to the Reading Meter Repair Company, Inc., Reading, Pa., for prices and particulars regarding testing or repairing water meters, using the name of this magazine.

Air Pump.—The Indiana Air Pump Company of Indianapolis, Ind., will be pleased to send upon request a catalog giving details regarding construction and operation of air-lift method of pumping wells. If writing this company, kindly give the name of our publication.

Porous Concrete Well.—Upon receipt of a request E. Thorpe, 1932 Illinois Avenue, East St. Louis, will send you a folder describing the advantages of the porous concrete well. With this information they send a list of satisfied users of this type well.

Force Pumps.—Bulletin 28-MF has just been issued by the Domestic Engine & Pump Co., Shippensburg, Pa., giving specifications and types of their pressure force pump units.

Adensite.—A liquid integral compound used in the gauging water for Portland cement concrete and mortar, is described in a folder recently issued by the Adensite Co., Inc., 116 West 39th St., New York. The folder contains many illustrations showing where the product has been used, and a list of buildings where installations have been made. Write for full particulars concerning this product to the manufacturer, giving the name of our magazine.

Sanitary Specialities.—Manufactured by the Servicised Products Corporation include Bituminous rope, sewer compound and sewer belts (both acid and root proof), and asphalt liner slabs, proof against sewer liquors. Illustrated literature giving complete descriptions and details concerning these products for obtaining permanently tight and lasting sewers will be sent upon request by the Servicised Products Corporation, 6051 West 65th Street, Chicago, Ill. If you will mention our publication when writing to Mr. A. C. Fischer of the Servicised Company for this information it would be greatly appreciated.

Moir-Buchanan Centrifugal Process.—This process is to obtain high density, low absorption and long life of concrete pipe. Rights to use this process may be secured through the Asphalto-Concrete Corporation, 1440 Broadway, New York City. If interested in learning about this process and how strength and durability are secured by this method write to Mr. Geo. H. Schroder of the Asphalto-Concrete Corporation, using the name of our magazine and ask for full particulars.

Chlorinator.—Bulletin W-21 issued by the Paradon Manufacturing Company of Arlington, N. J., describes in detail the Paradon Chlorinators for city and private water and sewage systems, industrial plants and swimming pools. If writing for this bulletin address Mr. R. V. Donnelly, care of the manufacturer. We would appreciate it if you would mention our publication.

Centrifugal Pumps.—In order to be of assistance to users in choosing the right pump for their needs, Bulletin 1632-I has been issued by the Allis-Chalmers, Milwaukee, Wis. Types for steam turbine drive, motor drive or gasoline engine drive are described to best fit the purposes of installation. Write to Mr. H. G. Hoffman for copy of this bulletin, mentioning Municipal News and Water Works.

Dragline.—Write to Koehring Company at Milwaukee, Wis., or to any of their branches in the principal cities, for Dragline Bulletin DL9. The ease of control and speed in functioning are important features of this heavy duty Koehring equipment. Mr. O. C. Dahlman will furnish bulletin on request. If writing mention our magazine.

Cast Iron Pipe.—James B. Clow & Sons, 201-299 North Talman Avenue, Chicago, with foundries at Coshocton, Ohio, Newcomerstown, Ohio, and Birmingham, Alabama, carry large stock of pipe at points where large supplies can be obtained on short notice. Wire or write them concerning your requirements, they will be glad to care for your needs without delay. Mention our magazine when writing this company.

Cast Iron Pipe.—The Central Foundry Company, manufacturers of cast iron pipe with offices located in the principal cities, will be pleased to have you call at the nearest office or write to the New York office, 420 Lexington Avenue, for complete information in regard to their product, an iron to iron joined pipe, allowing for expansion and contraction, vibration and uneven ground settlement. Used for water supply, fire protection and other service.

Hydrants and Valves.—The Mathews Fire Hydrants, built for easy installation and so that an extension section may be used to adapt them to new grades, are described in literature of the R. D. Wood & Co., Philadelphia. If you will write to Mr. C. Becker of this company he will gladly send you full information about their sand-cast and "sand-spun" centrifugal cast iron pipe fittings, valves, boxes and hydrants. Please use the name of our magazine if writing.

Lubricant.—The Dot Lubricant Equipment Company, Division of the Carr Fastener Company, Cambridge, Mass., has issued a unique little folder called "Little Journeys in Dot Lubrication," illustrating and describing the various steps in the use of this lubricant. The trip described is that of taking the grease from the storage tank to the bearings quickly, comfortably for the user, absolutely free from dust and dirt.

Meters.—The Union Water Meter Company of Worcester, Mass., with offices in New York City and Philadelphia, will be pleased to send you literature concerning their King Frost Protected Meter, built to overcome every known weakness in frost meter design. If interested in meters of this type write to Mr. E. K. Otis for full particulars. We would appreciate it if you would mention this publication.

Valves.—Golden-Anderson Valve Specialty Company located in the Fulton Building, Pittsburgh, have issued a descriptive and data catalog on their automatic valves for steam and water service. Full details are given on each page as to construction, operation variations together with cross-section drawings. Data required for ordering is made very clear. If you desire a copy of this catalog write to Mr. J. A. Voland of the Golden-Anderson Company mentioning the name of our magazine.

Francois Cementation Process.—The Dravo Contracting Co. have acquired the sole American rights to the Francois patents, and have a highly skilled staff who will be pleased to help you with your problems. This method of grouting covers chemical processes for a hundred and one different cases, the engineers of the Dravo Company are ready to help you solve your problems. Write to their company at Pittsburgh, Pa., mentioning our magazine.

Hydrants, Valves, etc.—Full particulars for supplies needed by water works and fire departments will be sent upon request by the Bourbon Copper & Brass Works Co., 618 E. Front St., Cincinnati, Ohio, manufacturers of fire hydrants, gate valves, and extension valve boxes. Write for their catalog, giving the name of our magazine.

Sewer Cleaning Machine.—W. H. Stewart, whose factory is at Walkerville, Ontario, has branches in St. Louis, Mo., Jacksonville, Fla., and Boston, Mass., so that his patrons on this side of the border may be served without paying duty. Literature describing his sewer and conduit rods will be furnished on request. Rods will be shipped on trial. If writing to Mr. Stewart for information concerning his equipment kindly mention our publication.

Zeolite.—"Softening Municipal Water Supplies by the Use of Zeolite" is the title of a bulletin issued by the Zeolite Chemical Company, 140 Cedar Street, New York City. This booklet describes Green Sand, a natural base exchange Zeolite Mineral, used for the purpose stated. Write to Mr. R. E. Wagner of the Zeolite Company for a copy of this bulletin. If writing, we would appreciate it if you would mention this magazine.

(Continued on page 46)

THE durability and economy of highways surfaced with Stanolind Cut-Back Asphalt has been well demonstrated on many roads throughout the Middle West.

Main Street at Hutchinson, Minn., was surfaced with Stanolind Cut-Back Asphalt, using 3/10 of a gallon per square yard, and 20 pounds of Torpedo Gravel per square yard. Roller was used to surface.

Applying Cut-Back Asphalt

Spreading covering material

Completed Roadway

Stanolind Cut-Back Asphalt

asphalts for every purpose

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MICHIGAN
Detroit
Grand Rapids
Saginaw

MINNESOTA
Duluth
Mankato
Minneapolis

MISSOURI
Kansas City
St. Joseph
St. Louis

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Manhole and Catch Basin Covers.—Write to Wm. E. Dee Company, 30 North La Salle, Chicago, Ill., for particulars concerning the different types of manhole and catch basin covers. Prices will be included on request. If writing, kindly use the name of our magazine.

Chlorination.—Wallace & Tiernan, Newark, New Jersey, manufacturers of chlorine control apparatus will be pleased to send you full particulars in regard to the sterilization of water by their method, and to furnish you with record of cities where their apparatus is being used. If writing for information, we would like to have you mention our magazine.

Rayflectors.—The trade name of patented reflecting devices designed for utilizing light from automobile headlights, or other outside sources, to make signs and signals visible at night. The Rayflectors are manufactured by the Ray-Signs Corporation, of New Haven, Connecticut, and are described and well illustrated in a very attractive, well bound, 12-page booklet. These devices come in three sizes and in white, red, green and amber. This black and gold booklet will be sent upon request by the manufacturer, and we would appreciate it if you would mention our publication when writing.

Lubrication.—The story of the Alemite Manufacturing Corporation system of lubrication issued in magazine style. This pamplet, Lubrication Maintenance, is published in the interest of better industrial lubrication and lower production costs, and will be mailed free to any one interested. If writing for this booklet, will you kindly mention our publication? The address of the Alemite Manufacturing Company is 2646 North Crawford Avenue, Chicago.

Valves.—The Darling Valve & Mfg. Company with offices in New York, Chicago, Houston and Oklahoma City and headquarters in Williamsport, Pa., will be pleased to send you full information in regard to the design and performance of their valves which are built to minimize friction and wear. If writing for literature to Mr. A. G. Smith at the Williamsport office of the company, kindly use the name of our magazine.

Bags.—Let the Bates Valve Bag Corporation, 35 Wacker Drive, Chicago, tell you about their multi-wall-paper bags in a very attractive folder which they have recently issued. These bags are proving of inestimable value to the contractor in protecting his plaster from losses by the elements. This company also manufactures the Bates Ties and Tools for the use of contractors in speeding up reinforced concrete work, by fast, tight, non-slipping ties requiring no special skill to apply. Write to this company for their latest literature, mentioning the name of our publication when writing.

Electric Power.—A very attractive forty-eight page booklet, well bound and profusely illustrated, is now being distributed by the Electric Machinery Manufacturing Company of Minneapolis, Minnesota. It is devoted to the subject of power factor correction with capacitors (static condensers). The title of the book is "Reducing the Cost of Electric Power" and gives a non-technical explanation of power factor and shows when and how to apply capacitors to reduce electric power cost. It also explains the construction of capacitors. This company has offices in all the principal cities where copies of this book may be secured, or from their main office at Minneapolis.

Dredges.—Catalog E issued by the Norbom Engineering Co., Darby, Pa., gives full particulars concerning the Norbom Hydraulic Dredges. These dredges will be built to suit your special requirements. Write for a catalog giving the name of our magazine.

Inertol.—This is a waterproofing and anticorrosive compound for impregnating concrete surfaces and for protecting steel, making the structures waterproof under pressure and immune against aggressive chemicals. This is manufactured by the Inertol Company, Inc., 253 Broadway, New York City, and stocks are carried in Newark, N. J., Chicago and San Francisco. In color it is a glossy black and comes ready for use, and needs no skill in applying, but is used cold with brush or paint sprayer. An illustrated broadside has just been received from this company giving the many uses for this product, prices, etc. Write to the manufacturer for full information, mentioning this magazine.

Meter Testers.—A catalog giving complete information on the Mueller Meter Tester will be sent upon request if you will write to Mr. C. N. Wagenseller of Decatur, Illinois, mentioning this publication, or they may be secured at any of the branch offices of this company. The Mueller Meter Testers are simple of operation and of a lasting quality of construction. Statistics show that meters under-register oftener than they over-register and an accurate meter tester insures honestly earned revenues. Meters should be tested befor installation and at regular periods thereafter. The Mueller catalog will give you complete information on this subject.

Hydraulic Dredge Capacity Indicator.—The Ellicott Machine Corporation, 1111 Bush Street, Baltimore, Maryland, specialists in dredging outfits, are equipped to furnish you with well designed hydraulic dredge, either diesel, electric, gasoline or steam driven, built for efficient and economical service. Mr. C. E. Ellicott, Jr., will be pleased to furnish you full information concerning outfits for jobs of all sizes. If you will mention this magazine, he will send for your convenience a hydraulic dredge capacity indicator.

Governors.—How to increase production and profits and lower operating costs, by the use of Pierce Governors, is described in Booklet No. 14, issued by the Pierce Governor Company, of Anderson, Indiana. This equipment on power engines results in a smooth, uniform flow of power to meet every load. Fuel, operating and repair bills are reduced and the life of engines prolonged. Mr. D. J. Nolan, of the Pierce Governor Company, will be pleased to send you a copy of this booklet, and we should be pleased if you would mention our magazine when writing.

Portable Compressors.—Ingersoll-Rand Company, 11 Broadway, New York City, will be glad to send you catalog describing their gasoline engine or electric driven portable compressors, in six sizes. If writing for this information, will you please mention our magazine.

Steel Sheet Piling.—Lackawana Steel Sheet Piling, particularly suitable for the long sea wall. For information regarding this product write to the Bethlehem Steel Company, Bethlehem, Pa. Mr. S. H. Yorks is sales-manager. If writing Mr. Yorks, give the name of our magazine.

Pumps, Engines, Hoists.—If you have hoisting problems, write to Mr. Clarence E. Bement, of the Novo Engine Company, 200 Porter Street, Lansing, Michigan, asking for a free copy of Novo Hoisting Handbook. This is not a catalog but a book of useful information for the man who must meet hoisting problems. They will also be glad to send you full particulars concerning their entire line of products.

Lumber.—For the users of lumber, the National Lumber Manufacturers' Association, Transportation Building, Washington, D. C., has much valuable information in booklet form, which they will be glad to send you. Bulletin No. 16 is called "Simplified Practice" and another booklet containing much general information is called "Information on Lumber and Where to Find It." Either of these booklets will be sent without obligation by addressing the company at Dept. 4651, at the address given above. If applying for a copy, kindly use the name of our magazine.

Water Softeners.—The International Filter Company, 333 West 25th Place, Chicago, present in an illustrated bulletin Crystalite, a water softening product. This is an attractive 16 page booklet, well printed on heavy enamel paper. It discusses the chemistry of zeolite water softening; the early history and development of zeolites; Crystalite as a super rapid zeolite; the advantages of upflow softening illustrated with curves. Crystalite Water Softeners installed by the International Filter Company are illustrated, and special industrial uses for Crystalite are listed. If writing for this bulletin, kindly mention our magazine.